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AUGUST 20¢

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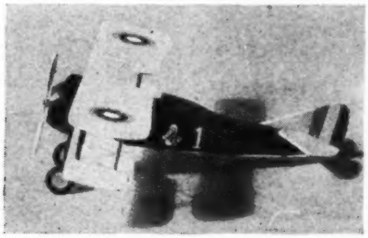

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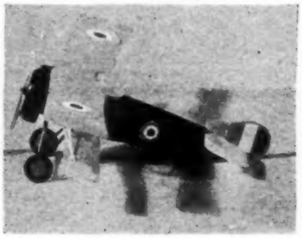

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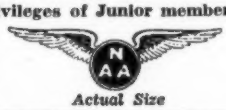

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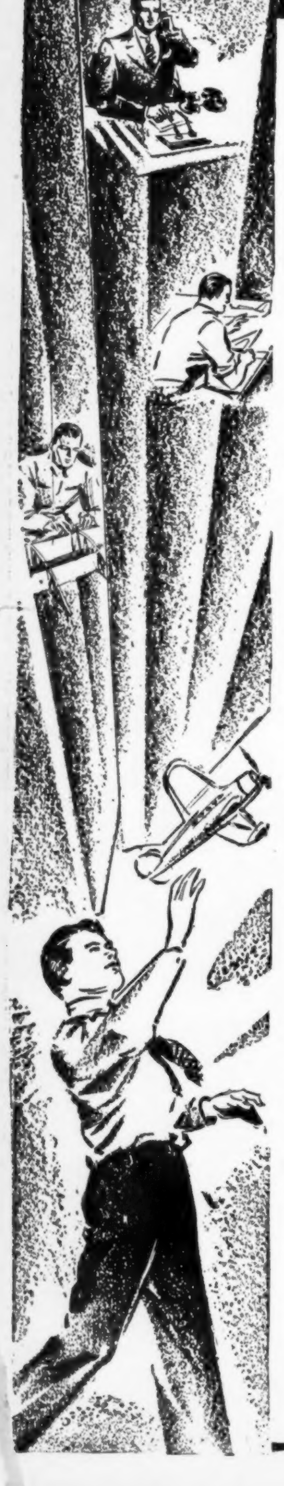


VOL. XI **No. 1**

Edited by Charles Hampson Grant

CONTENTS

AUGUST, 1934

In Our Next Issue

We take great pleasure in presenting the first of a series of articles by our old friend, Lt. H. B. Miller, entitled **Acrobats of the Sky**.

The second part of **Building Models for the "Tunnel,"** by Alexander Klemin, gives complete details embodied in the art of wind tunnel model building.

Mr. C. L. Bristol presents plans and complete instructions to build a remarkable flying model of the Macchi-Castoldi, world's speed record seaplane.

Joseph Kovel shows you how to build a contest flying scale model of a Stinson Jr. which has flown for 2 min. 1-3/5 sec. in **Build This Record Breaking Stinson Jr.**

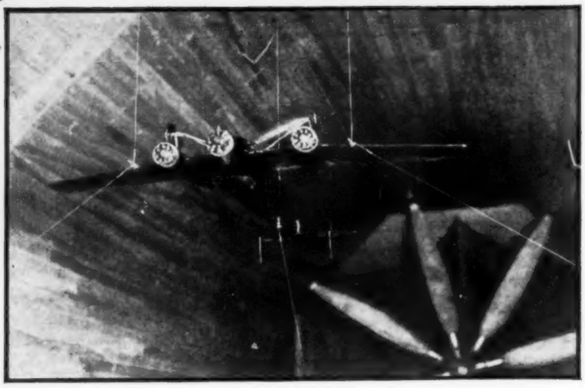
Robert C. Hare uncovers more mysteries about Fokker's World War planes in **The Development of the Fokker Fighters.**

Fundamentals of Model Airplane Building, by Edwin T. Hamilton, leads you still further along the road of successful model building by presenting an all balsa practice model that flies under all conditions.

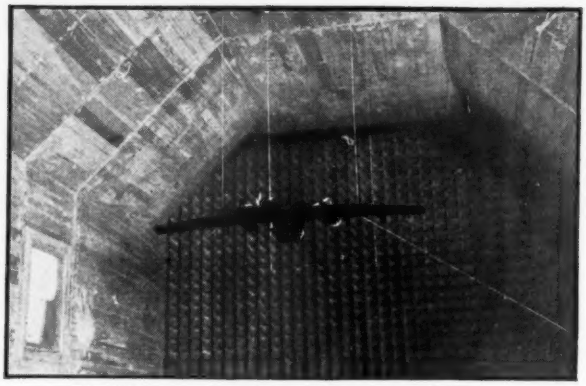
Other presentations such as **How The Aeroplane Was Created, The Aerodynamic Design of the Model Plane, Illustrated Aviation Dictionary, On the Frontiers of Aviation, Air Ways, Aviation Advisory Board,** and **Junior N.A.A. News,** makes our September issue one of the best.

Published Monthly by JAY PUBLISHING CORP., Myrick Bldg., Springfield, Mass.
Editorial and General Offices, 551 Fifth Avenue, New York City.
George C. Johnson, President. Jay P. Cleveland, Secretary
Jay P. Cleveland, Advertising Manager, 551 Fifth Avenue, New York, N. Y.
Entered as second-class matter June 5, 1929, at the Post Office at Springfield, Mass., under the Act of March 3, 1879.

Price 20c a copy. Subscription price $2.00 a year in the United States and its possessions; also Cuba, Mexico and Panama.
$2.00 in Canada. All other countries $2.50 per year.



Model in the Tunnel. Propeller in background



The Honeycomb which straightens the airflow

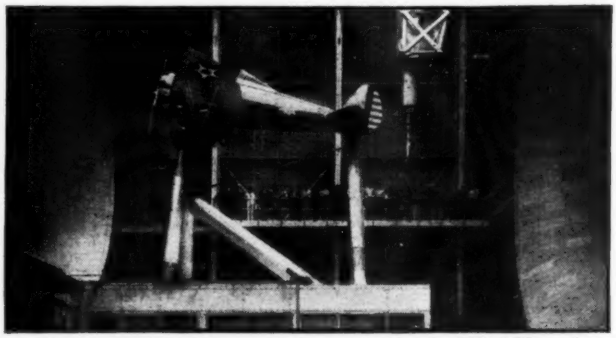
Building Models for the "Tunnel"

Part No. 1. The Wind Tunnel and Its Uses. A Description of a Modern Wind Tunnel and How It Plays an Important Part in the Design of Efficient Airplanes

By ALEXANDER KLEMIN

Director, Daniel Guggenheim School of Aeronautics, New York University

THE wind tunnel is a very useful device for experimentation and research in every branch of aeronautics, particularly in the design of airplanes. It is by no means new. Thus Wilbur and Orville Wright, years before they built their first airplane, constructed a small wind tunnel which they used to such good effect that their first powered machine was immediately a complete success from an aerodynamic point of view. Their general results on the lift, drag and stability of various airfoils, stand valid to this day. They have never been officially published and were noted in a little vest pocket note-book. This little red book has priceless historic value, yet Orville Wright persists in carrying it round with him to the horror of his friends.



A full size Boeing P26A ready for testing in the Wind Tunnel at Langley Field

Since those early days, wind tunnels have improved enormously in accuracy and facility of measurement and they are now used, almost without exception, in the design of every new airplane.

There is plenty of justification for presenting this article to our readers. Beside the general interest which flying model builders have in experimental aerodynamics, their work touches very closely on the technique of the aerodynamic laboratory in the construction of the wind tunnel models. These must be supremely accurate, smooth and well finished in every way. In some respects wind tunnel models are easier to build than flying models, since they are tested in a stationary condition. In accuracy, particularly of wing contour, they are much more exacting. In fact every measurement must be perfect.

What Is a Wind Tunnel?

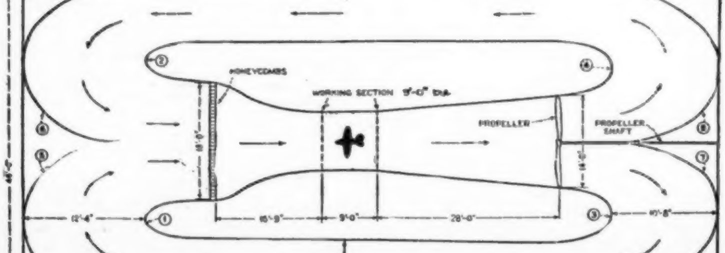
This is not a difficult question to answer, once a certain fundamental principle has been established. If a man is rowing a boat at four miles per hour, he exercises a certain force. Now suppose he is rowing against a current of four miles per hour; he will then in relation to a tree on the river bank, not be moving at all. But he will still be exercising the same force as if his boat were moving at four miles an hour in still water.

In similar fashion, the lift and drag of an airplane model will be just the same whether it is flying through the air at sixty miles an hour, or held at rest in a wind stream of sixty miles.

Because it is so much easier to measure forces on a stationary model than on one rushing through the air, the model is mounted in a fixed position in the center of the tunnel, and the air is drawn past by means of a powerful propeller fan.

A Typical Wind Tunnel

A typical wind tunnel is shown diagrammatically, but with accurate dimensions, in the first of our illustrations. The airplane model is suspended in flying attitude in the "working section" of a 9 foot diameter. Past this model, the air is drawn by a rapidly revolving propeller type fan (14 feet in diameter and eight-bladed), driven by an electric motor through a long shaft. The "working section" is in the narrowest part of the channel because it is here that the highest air speed (as high as 100 miles per hour), is required. Once past the working section, the air moves in an expanding cone, and after being driven through the propeller, divides into two streams. It is guided into the return channels by carefully designed, semi-circular walls. Then it passes into the long return channels; where it loses the eddies introduced by the propeller and gradually slows down. Again moving round curved walls,



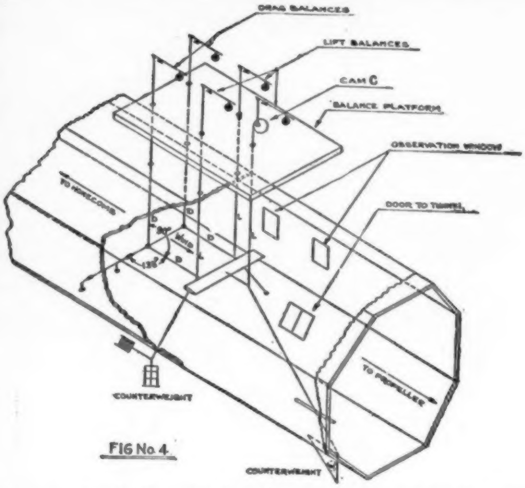
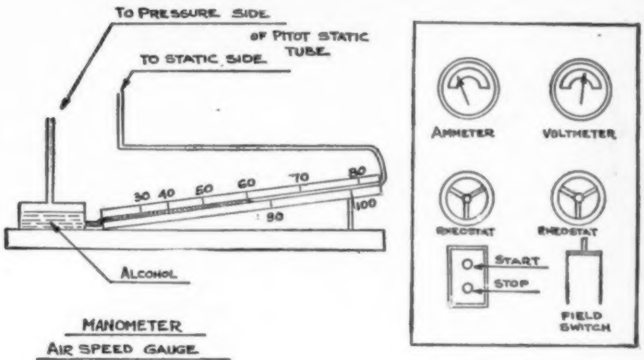


FIG No 4.



MANOMETER
AIR SPEED GAUGE

CONTROL PANEL

FIG. No. 8

CONTROL PANEL AND AIR SPEED GAUGE

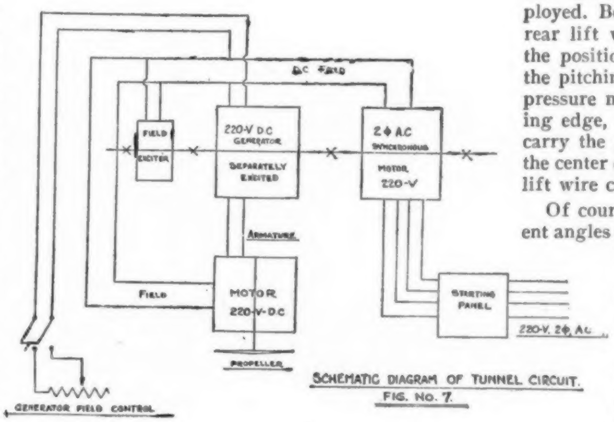
it passes slowly through the "honeycomb" built after the fashion of a huge radiator. In the radiator, the air is made smooth and uniform so that it is again ready to work correctly on the suspended model.

The air circulates round and round in this fashion as long as the experiment is continued. The photograph of Fig. 2 shows a view of the tunnel looking toward the honeycomb, with a model suspended by wires from the balances above the tunnel. Of course, the working section is provided with doors for entry and windows for observation. In Fig. 3, the same model is shown suspended from the balance wires, with the eight-bladed aluminum propeller in the background.

Suspending the Airfoil Wires

In Fig. 4 there is shown a diagram of how an airfoil is mounted for test of lift, drag and pitching moments. The automatic weighing balances are all mounted on a special platform, placed well above the wind tunnel, and the wires holding the airfoil in position are suspended from the ends of the weighing levers. In this particular test there are five balances in use: two drag balances, two front lift balances, and one rear lift balance; and accordingly five suspension wires are employed. Two heavy counter weights are shown in our sketch, whose purpose is to keep all the wires in tension and nicely taut. In each suspension wire, a turnbuckle of the ordinary airplane type is introduced for careful adjustment and alignment. The airfoil is mounted upside down so that the lift acts downwards. This is done merely because it is easier to measure a downward force on the balance.

In this sketch the air is shown moving from right to left, so the drag of the airfoil is also from right to left. This drag acts on the wires marked D, and puts a tension in the counter-drag wires which are fastened at one end, to the bottom of the tunnel. The counter-drag wires are placed exactly at 135 degrees to the wires D, and it is highly important that this angle should be exactly 135 degrees. The simple force diagram of Fig. 5 will indicate why this is so—with the triangle of two equal 45 degree angles, the drag of the airfoil and the tension in the vertical wires going to the drag balances must be exactly equal.



SCHEMATIC DIAGRAM OF TUNNEL CIRCUIT.
FIG. NO. 7.

The action of the lift balances is quite evident. The lift of the airfoil acts downward and the *sum* of the readings in the three lift balances is equal to the total lift of the airfoil. It may be asked why front lift wires and a rear lift wire are employed. Because by the use of front and rear lift wires, it is possible to compute the position of the center of pressure or the pitching moment. When the center of pressure moves forward toward the leading edge, it is the front lift wires which carry the greater load. Conversely, when the center of pressure moves back, the rear lift wire carries the greater force.

Of course an airplane can fly at different angles of incidence or attack to the air. So we must be able to change the setting of the airfoil in the wind tunnel. This change in setting is very easily accomplished.

The airfoil is hinged at the points of attachment of the front lift wires. Towards the rear it is supported by a rigid rod or string. By moving the cam C, the end of the rod can be raised or lowered and the angle of incidence increased or decreased accordingly.

The Balances

In Fig. 6 is still another diagram, that of one of the weighing balances, a delicate and complicated piece of apparatus. As the lever or balance beam is pulled down

(Continued on page 39)

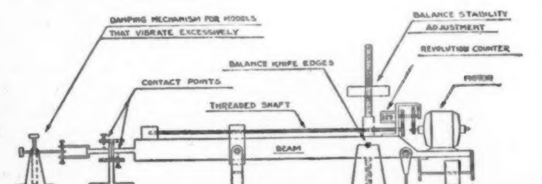


FIG No 6 — WIND TUNNEL BALANCE

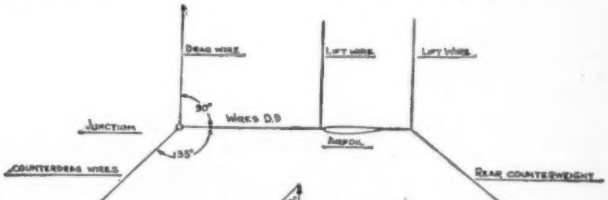
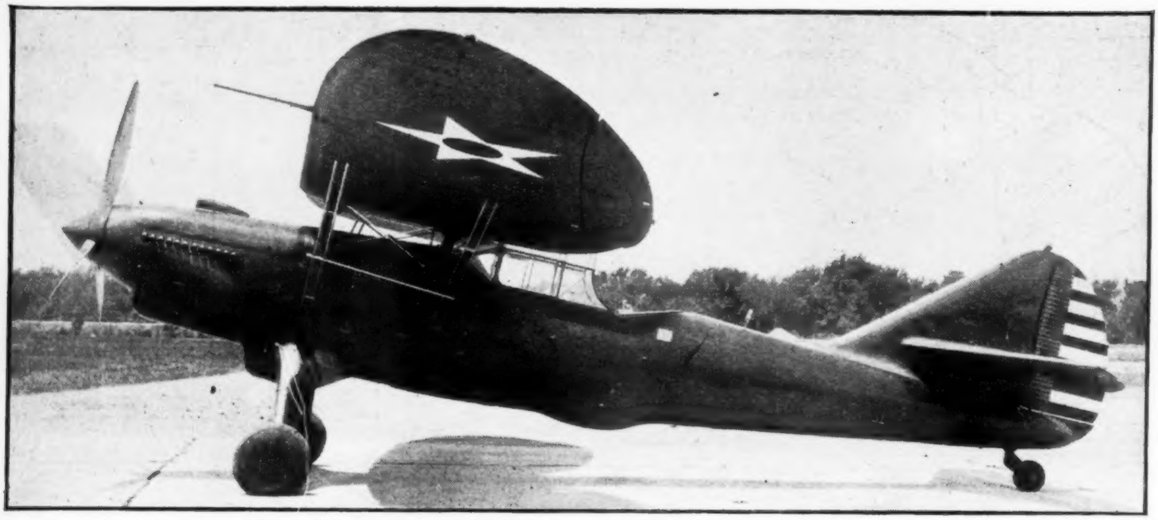


FIG. No. 5 — DIAGRAM OF FORCES AT JUNCTION.



The Douglas Y10-43, one of the fastest observation planes in the U. S. Army

On the Frontiers of Aviation

High Lights of the Latest Airplanes and How You Can Make a Solid Scale Model of The Douglas Y10-43 Observation Plane

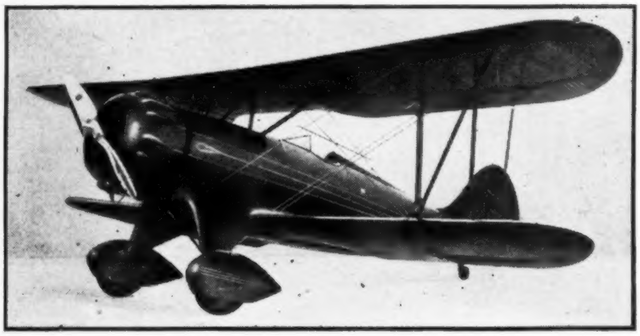
By ROBERT C. MORRISON

MORE interesting information about the new Martin trans-Atlantic flying boats has been made known by Glenn L. Martin, designer and builder of the gigantic planes. Each of the plane's wing spread will surpass the Dornier DO-X's wing spread by twenty feet, making them the largest flying boats in the world! The planes with full load (including fifty passengers), will be capable of flying from New York to Paris in 24 hours.

The first of the three Martin ships being built for Pan-American Airways will be completed by October 1st, 1934, the second by April 1st, 1935, and the third by June 1st, 1935. Pan-American Airways will put them into trans-Caribbean service before the trans-Atlantic run in order to test their performance with care. The power plants of each ship will probably consist of four of the new twelve-cylinder, two-cycle Deschamps Diesel engines, recently produced by the Lambert Engine & Machine Co., whose engines now power nearly all Monocoupes.

Estimated specifications of the Martin flying-boat follow:

Cruising speed, 150-180 m.p.h; horse-power, 7,000 (four motors of new design); pay load, 10,000 pounds; fuel capacity (lbs.), 42,000 pounds; structural equipment weight, 48,000 pounds; total weight (full load), 100,000 pounds; passenger capacity, 50; crew, 5; wing spread, 180 feet.



The new sleek Waco U.M.F. Single Place Biplane

There are once more signs of life at Harold Pitcairn's factory at Willow Grove, Pennsylvania. It is said that five wingless autogyros are on the production line! News has reached us from authoritative sources that the 'gyros will be capable of taking off with a run of only five feet and will be able to remain in the air at a surprisingly low speed of 2 m.p.h.!

Major De Seversky is having a land gear built onto his ship at the Edo float concern on Long Island Sound, N. Y., to take the place of the amphibian gear formerly employed on his high-speed racer. He expects to attain a speed of 280 m.p.h., and will compete in the London-Melbourne race. Fourteen of these planes are now being built for a South American government.

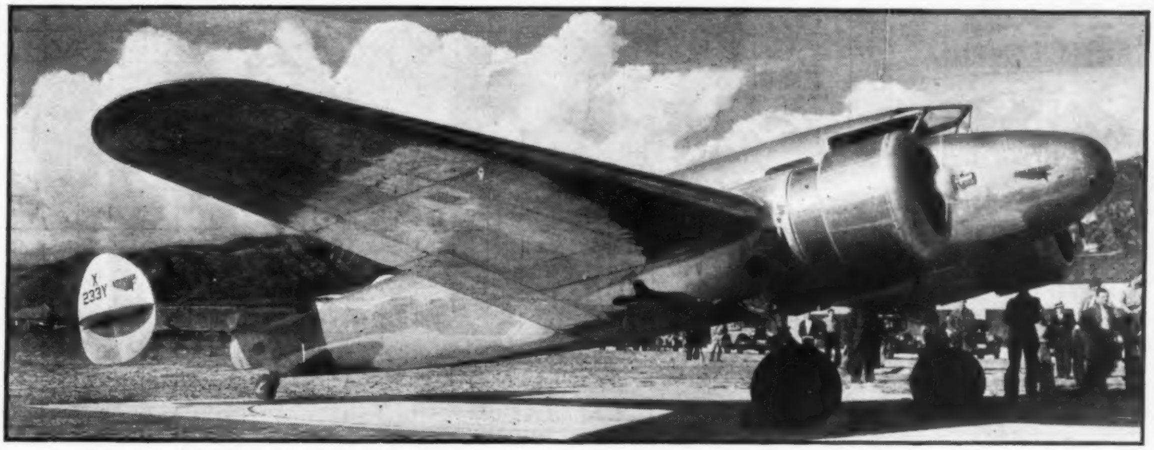
Anthony Fokker, who has acquired the license for the sale and construction of the Douglas DC-2 in many parts of Europe, is now working on a military version of the famous high-speed transport. The plane may be used as a high-speed bomber, torpedo seaplane, troop transport, or as an ambulance plane.

The Dutch K.L.M. Company intends to enter their recently purchased Douglas DC-2 in the London, England-Melbourne, Australia, Race in October.

Among the latest military planes is the Bellanca pursuit for the U. S. Navy. Though Mr. Bellanca has been supplying the U. S. Army, Navy and Marine air forces with large cabin planes, this is the first time he has undertaken the production of a high-speed pursuit ship for our government. Its cruising speed is said to be about 190 m.p.h., and it is undoubtedly a low-wing monoplane.

More news has been obtained about the new Boeing cabin pursuit men-

Here is the 225 h.p. Waco Y.K.C. cabin plane



The latest Lockheed Electra with two sets of vertical tail surfaces. High speed, 221 m.p.h.

tioned in last month's article. The plane will have an estimated speed of 265 m. p. h., which is made possible by a 700 h. p. nine cylinder Pratt & Whitney engine.

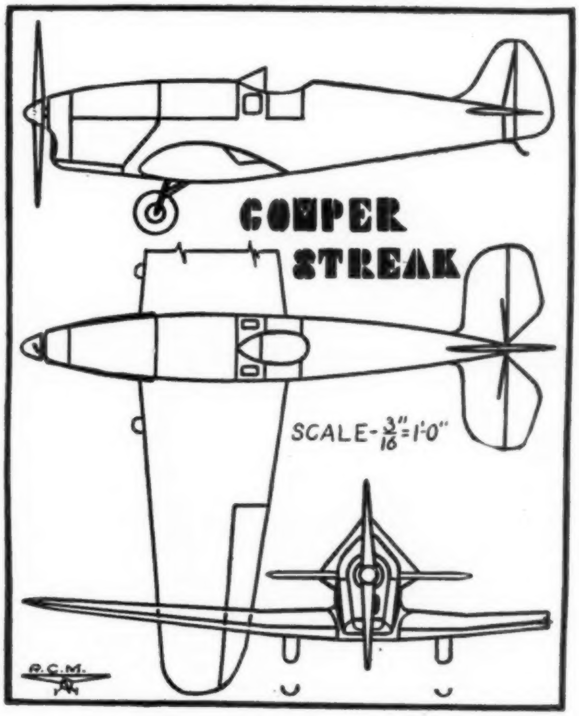
The Grumman concern has received an order for five of its new utility amphibians from the U. S. Navy. The design of the floats and fuselage is on the same general principle as that of the old Loening OL-9, the float being built right into the bottom of the fuselage. The ship has a very fast appearance.

Vought also has out a new plane, a version of the well known V-80. Exhibition flights are now being conducted with the ship in South America. It has a cruising range of about 700 miles.

General Aviation has built its first GA-43 as a seaplane. It will ply along Scadta's airways in Colombia, South America.

Performance figures of the new Cessna are now available. They are as follows:

Type, Four-place cabin land monoplane; power plant, Warner "Super Scarab," 145 h.p.; wing span, 33' 10"; high speed, 165 m.p.h.; cruising speed 146 m.p.h.; landing speed, 47 m.p.h.; cruising radius, 585 miles (17 miles on a gallon)!



Demand for high speed and economy in air transportation has resulted in a flood of inquiries and orders for the 221 mile an hour bi-motor Electra airliner now under production by the Lockheed Aircraft Corporation, Burbank, Cal., according to Carl B. Squier, vice-president and sales manager.

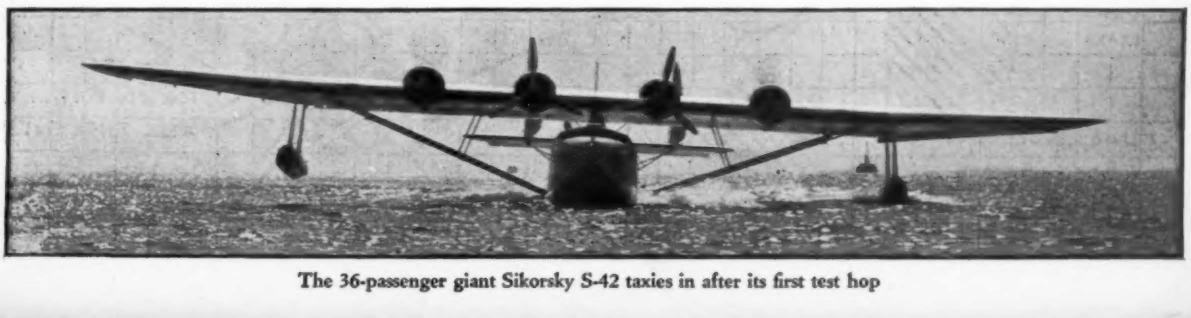
With an intensive three months of flight testing nearing completion late in May, the first Electra was being prepared for delivery to Northwest Airlines, St. Paul, and the Lockheed factory was rushing production on eighteen additional Electras for which definite contracts were on hand.

As things exist now, it seems that about 75% of the planes entered in the much talked of London-Melbourne Air Race this coming October will either be of American design or contain American-made motors. Our superiority in high-speed aircraft has attracted the attention of a great many famous foreign pilots, such as Col. James Fitzmaurice (one of the trans-Atlantic "Bremen" crew), Sir Charles Kingsford-Smith, and M. Michel Detroyat, who recently performed acrobatics at numerous air races here. It was on his visit to this country that he ordered a Lockheed Orion (less motor) for the race. He will equip the plane with an Hispano-Suiza 9V air-cooled radial motor, which will be an interesting combination. The two other fliers also intend buying Lockheed ships, built especially for the race.

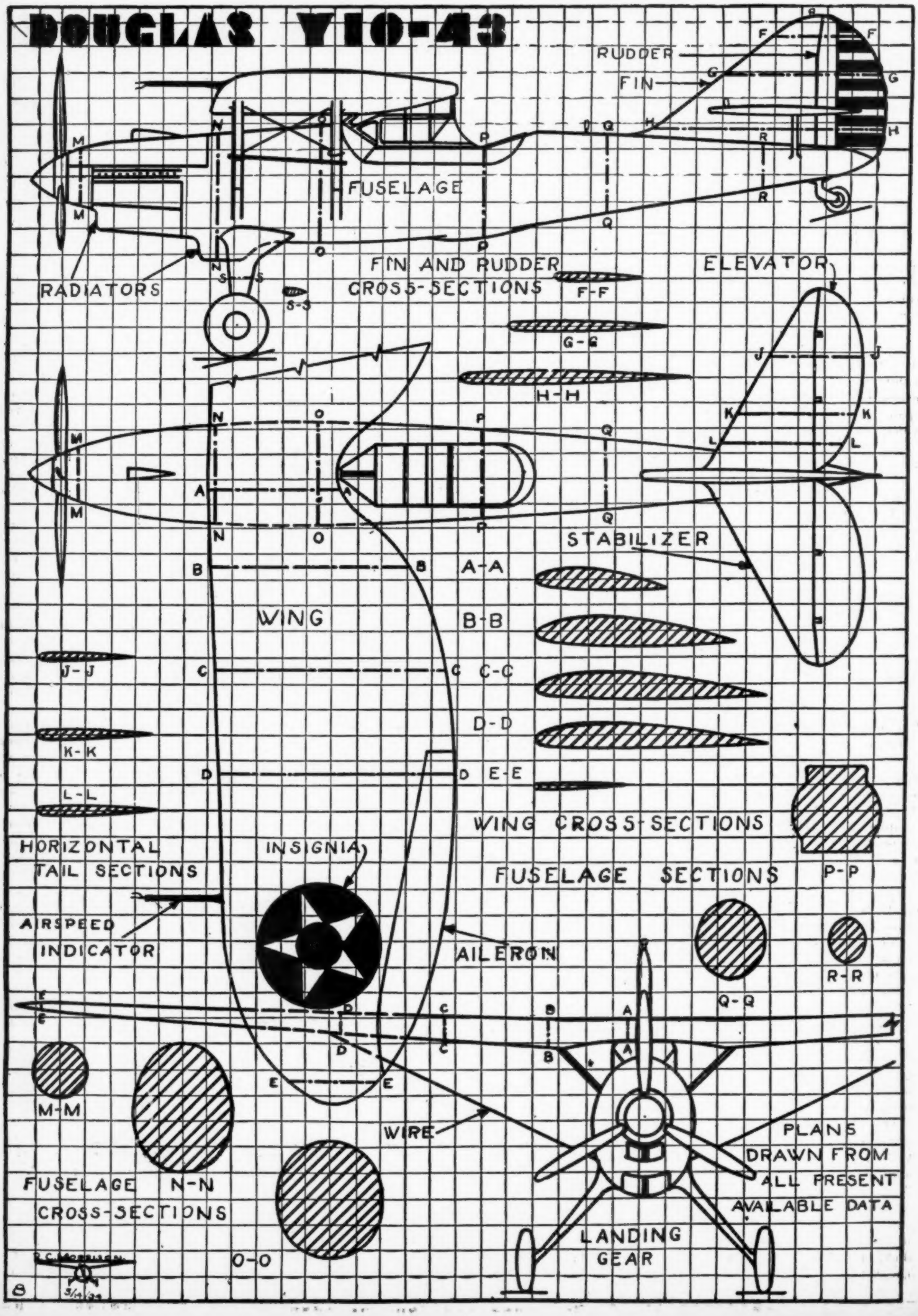
The Bleriot Company (French), and the Caproni Company (Italian), are secretly building racing planes to compete.

The Mollisons are entering the race with a De Havilland "Comet," several of which are now under construction for numerous other contenders.

(Continued on page 38)



The 36-passenger giant Sikorsky S-42 taxies in after its first test hop


DOUGLAS Y1O-43
RUDDER
FIN
FUSELAGE
RADIATORS
FIN AND RUDDER CROSS-SECTIONS
F-F
G-G
H-H
S-S
ELEVATOR
STABILIZER
A-A
B-B
C-C
D-D
E-E
WING
WING CROSS-SECTIONS
J-J
K-K
L-L
HORIZONTAL TAIL SECTIONS
INSIGNIA
FUSELAGE SECTIONS
P-P
Q-Q
R-R
AIRSPEED INDICATOR
AILERON
M-M
WIRE
PLANS DRAWN FROM ALL PRESENT AVAILABLE DATA
FUSELAGE N-N CROSS-SECTIONS
O-O
LANDING GEAR

The Albatros D-5a with high headrest

The Albatros D-5a, the fastest ship on the "front"

The Albatros Fighters on Parade

Intimate Details of the Albatros Planes Which Made the Germans Supreme in the Air in 1917

By JOSEPH NIETO

Part No. 2

JANUARY 1917 saw the odds in aerial combat about even on both sides of the front.

The Albatros D-1, D-2 and D-3 had served most effectively to slow down the offensive onslaught of the French Nieuport, Spad and British S.E.5 warplanes, which were about the most drastic Allied fighting machines of that time.

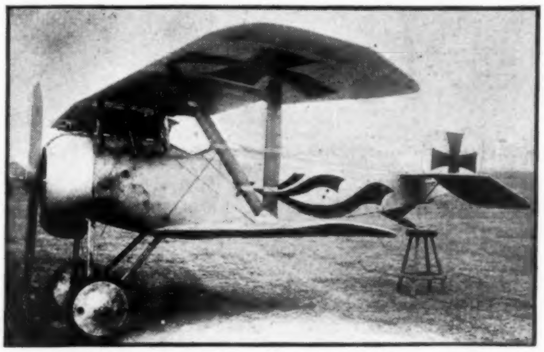
A synoptic rating of the foremost pursuit or fighting warplanes of the early part of 1917 might have been registered as Spad 7, Spad 13, Nieuport 27, Nieuport 28, S.E.5 and Sopwith Camel, with the Allies; and Albatros D-3, Fokker D-6 and Roland D-3 on the German side.

It was in the early months of the year 1917 that the officials of the German Imperial Air Service jubilantly accepted the Albatros D-5 for front line fighting service. Here was a destructive weapon of war which, when handed over to Germany's most excellently experienced ace-pilots, would surely sweep the battle skies of all antagonistic enemy planes! This was the confidence in which the Albatros D-5 was accepted, but how completely it did manifest itself in the purpose for which it was designed, might as well remain as another of the untold horrors of the war.

It seems that at this stage of the war, the British Flying Corps pilots with their Sopwith and S.E.5 fighting planes were intent on giving the exultant morale of the German Imperial Flying Corps a demoralizing blow. The entrance of the Albatros D-5 into war skies may be exemplified as a well aimed missile striking a hornet's nest.

It was at the time in the history of aviation when dog-fighting was at the height of its fury, that this most efficient German fighting warplane was destined to attain that height and arouse the most effective Allied fighting machines into fierce combat.

The D-5 is known to have shared its splendid fighting prowess by the side of its twin, the Albatros D-5a. These two machines produced in the early months of 1917, were almost identical. Both were constructed under the L-30 serial or firm name. The similarity that existed between these two D types has been confusing. Many of the war students seem to have believed the Albatros D-5 to have been a D-4 type, probably owing to the external details not presented in the conclusive D-5a.



A French Nieuport type No. 17, 1916 model captured by the Germans and used against the Allies

No official record of an Albatros D-4 being available to the writer, it is believed that a D-4 Albatros fighter was short-lived and did not pronounce itself with much if any front line fighting service. Demands for a super-fighting machine which introduced the Albatros D-5 types, seems to have obscured the mysterious D-4 Albatros.

It should be explained here that the Albatros D-5 was equipped with an average-sized headrest which was attached and filleted to the back of the fuselage. This machine also sported a fairly good-sized windshield that completely protected the pilot from the slipstream of the propeller.

In succeeding the D-3, the D-5 was normal in the advancement of the Albatros fighting warplane designs. Not entirely different in contrast to its forerunner, yet almost identical to the succeeding type, the D-5a.

The construction of the D-5 presented a higher step in the streamlining of the fuselage. The flat sides of the fuselage so conspicuous in the foregoing Albatros types, were filled in the D-5 to form a curved, rather oval cross-section outline. This alteration not only served to resist the broadside air pressure, but was confluent and conformed with the propeller wash that corkscrewed the length of the fuselage. This advanced step in the streamlining of the fuselage, called for additional longerons. Whereas the D-3 employed only six longerons to form its flat-sided body, the D-5 required an additional longeron on each center side to form the curved effect at that section. The method of arranging the longerons to the oval shaped members was much the same as that carried out in our modern Lockheed Vega fuselage.

In exception but for the width, the length and the height of the fuselage was the same as the D-3. The bullet-nose effect at the front of the fuselage was accentuated to conform with the additional width at the sides, then to taper to an oval cone at the tail. The wings were of the same dimensions, construction and shape as the D-3.

The upper wing consisted of two main spars running the full length of the one piece wing. Twenty-six cambered speed type ribs were attached to the spars about thirteen inches apart. The two and only ailerons employed were connected to the upper wing in the conventional manner, and characteristic of the Albatros design, were curved upward at the outer tips to aid the balancing section of the aileron.

The lower wing which was constructed in two pieces, was about fourteen and one-half inches shorter at each end than the upper wing. The chord was approximately two-thirds that of the upper wing. The same number of main spars held twelve speed type and cambered ribs in each half wing, set about twelve inches apart. Both upper and lower wing trailing edges were scalloped, following the trend of the Taube design.

The tail assembly of this machine was the same in construction and shape as employed in the D-3. This section conveniently served to identify the D-5 with its successor, the D-5a. When silhouetted at a distance in flight, were it not for the conventional straight edge at the rear of the rudder, the D-5 could have easily been mistaken for the D-5a.

The landing gear employed in the D-5 was the same as that employed in the D-3, and the arrangement of the twin Spandau

machine-guns was conventional, just as in the preceding types.

Powered by a 160 h.p. Mercedes engine, the D-5 was capable of climbing 3,300 feet in four minutes and boasted of an approximate speed of 130 m.p.h. The D-5 soon placed itself in the hearts of the most notable German aces assigned to the front line "jagdstaffels." Its excellent maneuverability at fighting altitudes, increases in speed and yet utmost safety in landings, were the welcome factors which pronounced the D-5 Albatros among all other single-seaters of its time.

The Albatros D-5a produced in June 1917, is reputed to have been the finest and most beautiful fighting plane of the war. Indeed it was the most efficient fighting machine that had been developed up to that time.

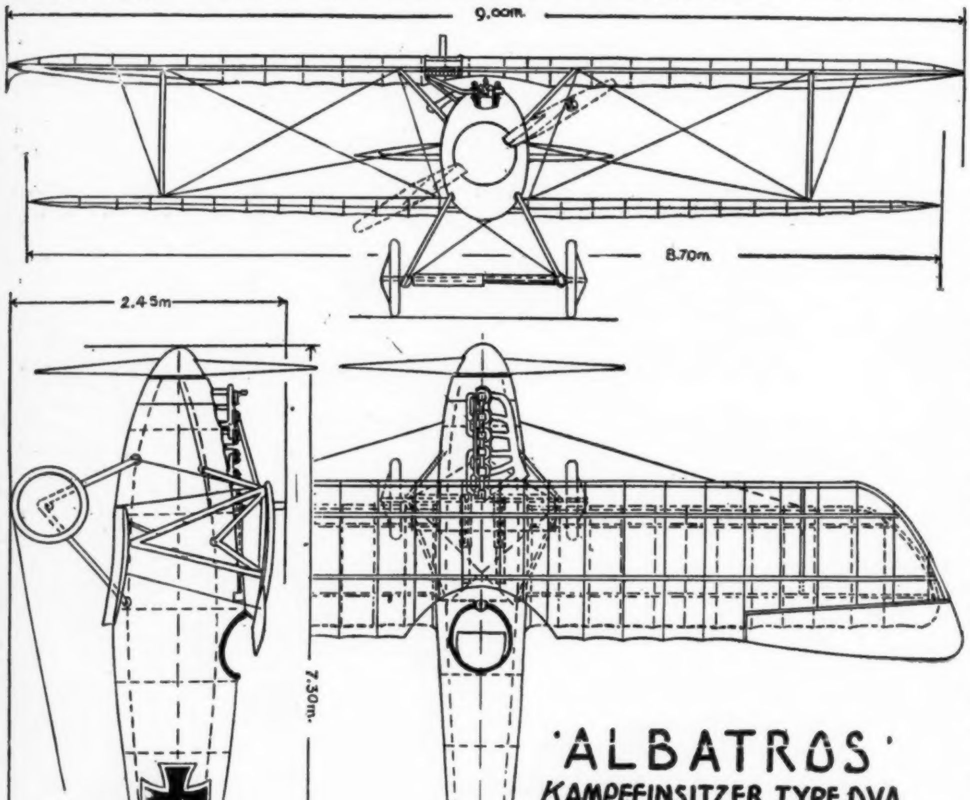
In all probability, the famous Fokker D-7 was the answer to the challenging and very antagonizing S.E.5 machine. It is generally known, however, that the Albatros D-5a was the closer antagonist to the S.E.5, for these two machines were most often seen engaged in fierce combat. The closest rival of the D-5a was the rare but very efficient Roland D-3 but, fortunately, the Roland fighting machines were lagging a bit behind as advanced productions.

In comparing the Albatros D-5a with the popular French Spad 13, this quotation is recorded in the memoirs of a noted Allied war-pilot in describing the Spad: "it is very fast and efficient, but when it meets the Albatros D-5a, unless the pilot is very expert and experienced, it has generally found its master and the fight ends disastrously for us." The facts that follow in the description of the Albatros D-5a prove that this machine excelled in general efficiency even the Fokker D-7 which type is reputed to have been "born" fourteen years ahead of its day.

The description of the D-5a evolves a quandary of "perplexive" details that environed this machine. At the time of its production, speed and maneuverability were relied upon to combat the enemy planes especially at high altitudes. It is believed that for this reason, some D-5a types were equipped with 200 h.p. Benz engines, enabling these "special" jobs to fly at a horizontal speed of over 160 m.p.h and climb at the rate of 15,000 feet in less than 12 minutes. Many of these "super" D-5a machines were equipped with three rapid-fire machine-guns in tandem arrangement.

These highly advanced machines as well as the "standard" D-5as employing the 160 h.p. Mercedes engine, were equipped with an electrical device which regulated the temperature of the water in the cooling system at all altitudes. The D-5a was probably the first war-time fighting plane to be equipped with an electrical starter. A new design of "Xial" (wood) propeller was equipped on this type.

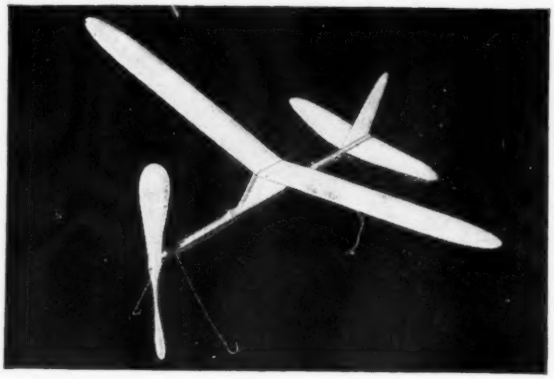
The fuselage of this machine was constructed identically as that of its predecessor. The drawings that accompany this article outline the arrangement of the eight longerons which were set into the eleven oval shaped members forming the plywood monocoupe fuselage tapering to a point at the tail.



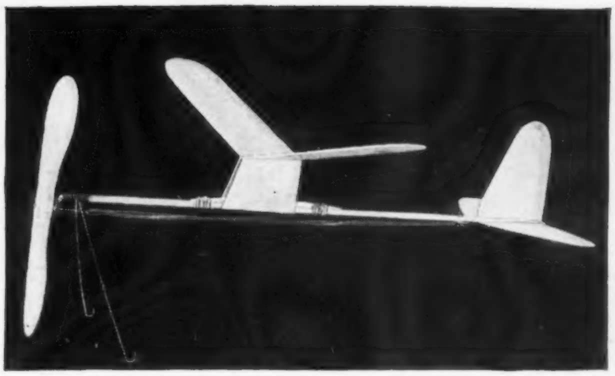
At the nose, the round metal disc between the root of the propeller and the engine served to form the bullet effect which was confluent with the outline of the oval members at the section ahead of the cockpit. At this section it should be noted that a slight opening between the metal nose disc and the spinner, purposely admitted a current of air pressure which passed the engine and through the metal vents attached to the plywood nose of the fuselage.

Some of the Albatros D-5a machines were known to have had as standard equipment a very tall headrest. This addition to the comfort of the pilot, gave this warplane a well finished and more advanced appearance, at the same time making the identification of the D-5a yet more confusing. Most of the D-5a machines were produced without a headrest. The explanation lies in the fact that owing to higher seating arrangements in conjunction with the machine-gun sights, the taller headrest was most essential. This detail, however, was easily removable in being screwed on to the fuselage, unlike the smaller headrest on the D-5 which was permanently attached and filleted to the fuselage. The windshield on the D-5a had later been reduced to a very small "wind-break-

(*Continued on page 46*)



A novice can fly this model 600 feet consistently



This hand-launch model is simple, efficient and stable

Fundamentals of Model Airplane Building

A Complete Course for Beginners Who Wish to Become Expert. How to Build Your First Powered Model —Part No. 4

By EDWIN T. HAMILTON

Models Designed by Charles Hampson Grant

HERE it is! The first power-driven model airplane to appear in this course. When its designer and builder handed me this model, I instantly recognized it as another accomplishment added to an already long list of successes on the part of a man whose name stands above all others in the field of scientific model airplane designing.

Its creation is the result of a year of experimentation with this particular type of plane. It will prove ideally suited for the novice learning the technique of model airplane building and flying. Following the progressive method of presentation, many of its features will be found similar in design to the corresponding features of the three gliders already presented in this course.

Its elevator and rudder follow closely the general lines of those parts of the glider appearing in the July issue. Its wing is similar in form to the glider wing given in the June issue, while the raised position of the wing above the motor stick, as well as the motor stick itself, copy similar features found in our first glider presented in the May issue. So here is a splendid power-driven flying model which might be called a glorified glider, because its various parts as well as its general assembly, have been literally borrowed from the three gliders already presented.

Test flights proved its stability so remarkable as to bring comment from spectators who knew nothing of model airplane flying. When wound fully with a winder, it is capable of flying for seventy to seventy-five seconds and covering in this time a distance of from one thousand to twelve hundred feet. When the winding is done by hand, it will easily travel for thirty-five seconds and cover a distance of six hundred feet.

Let's get busy and build this modern, up-to-the-minute model. Then we'll find a large open field, wind its motor, launch it and watch our first power-driven plane sail away on its maiden voyage!

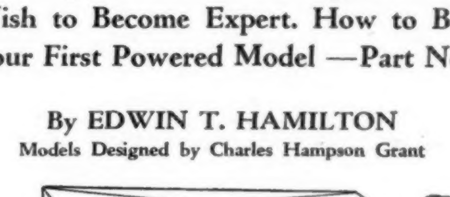


FIG. 2

Motor Stick

Read all instructions and carefully study the accompanying plan before starting work. Under "Top View" will be seen the line "Motor Stick 3/16" x ¼" Hard Balsa." Just under this is the dimension line of the stick showing its length to be 17". As the stick must be sandpapered smooth, one should be purchased at least ¼" thick, 5/16" wide and 17¼" long. Lightly sandpaper the stick down to exact size.

In the "Side View" will be seen the form of the stick. Its front end is rounded on the upper side while at a point 4" from its rear end, the stick tapers from its original width of ¼" to 1/16" at the end. Cut these after laying them out in pencil. Complete the cuts by sandpapering them smooth. This completes the stick except for its wire fittings, which will be discussed under "Wire Fittings."

Elevator

The elevator is cut to form from a piece of balsa wood measuring 1/32" thick, 2½" wide and 8" long. Note its form shown at the bottom of the plan in graph. Make a full-size pattern of the elevator. (See June issue, Page 8). The plan is shown on ¼" squares so your paper must be ruled with ¼" inch squares. Place the pattern on your sheet balsa so that the straight, trailing edge of the elevator is running parallel with the grain of the wood, and make the tracing in the usual manner. The elevator is now cut out and then finished by carefully and lightly sandpapering both sides and rounding its edges.

Rudder

A full-size pattern of the rudder is copied from the graph plan in the usual manner. This is traced on a piece of sheet balsa measuring 1/32" thick, 2½" wide and 3½" long. The

straight, trailing edge of the rudder must be parallel with the grain of the wood. The rudder is then cut out and finished with sandpaper in the same manner as the elevator.

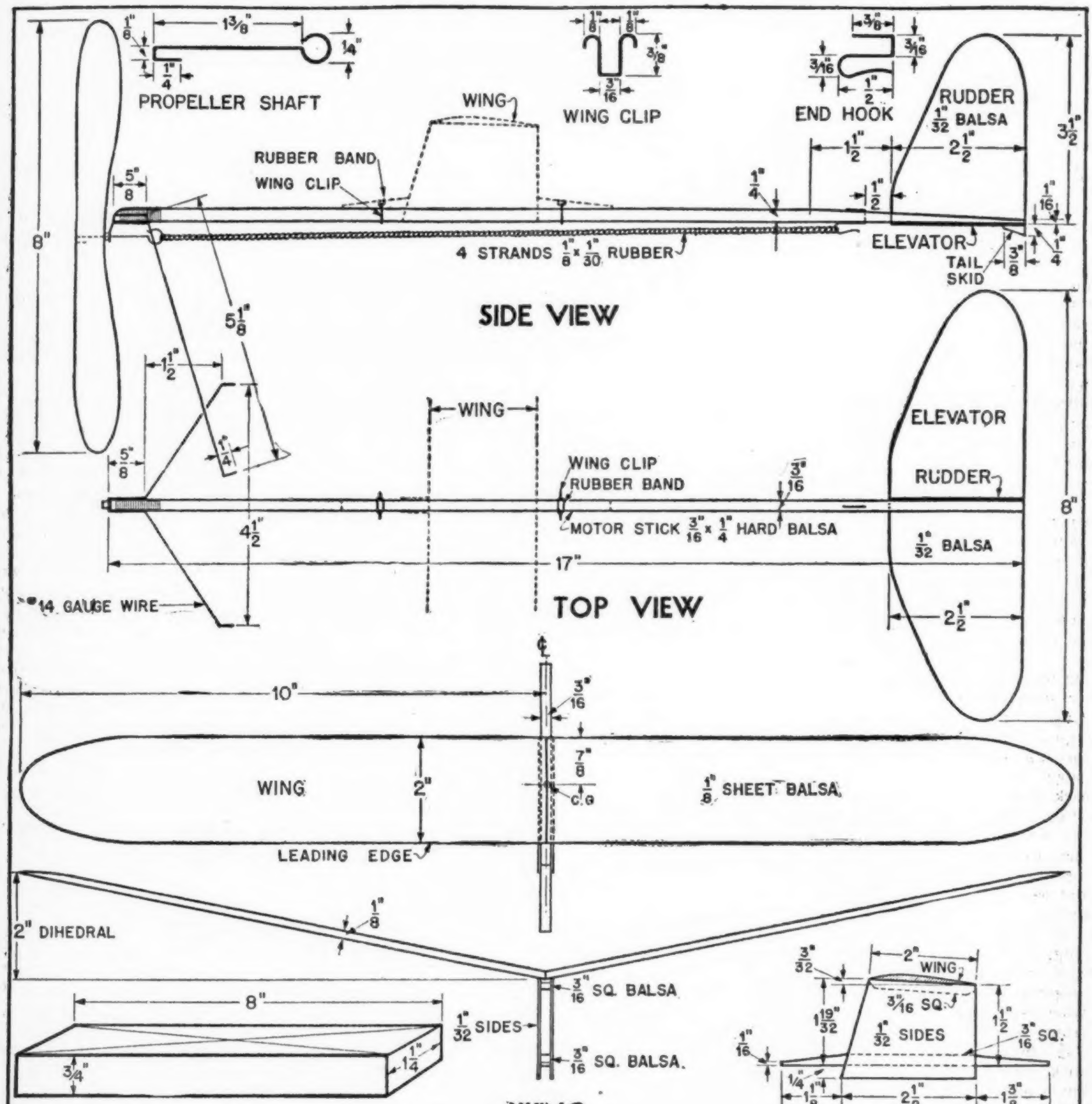
Tail Skid

This consists of a tapering block of balsa wood, as shown under the elevator in the "Side View" of the plans. It requires a piece 3/16" thick, ¼" wide and ⅜" long. Its under side is tapered from its original width of ¼" to a medium sharp edge, as shown in the plan.

Wing

Before making the wing, it will be well to carefully study the instructions given for the wing in the June issue on Pages 9 and 36. Obtain a piece of sheet balsa (soft), measuring ⅛" thick, 2¼" wide and 20½" long. Note the plan of the wing shown under "Wing". Its finished size must be 2" wide and 20" long. Square it up and cut to this exact size. Its ends are now finished, as shown in the graph plan under "Wing Tip." Make a full-size copy of this tip, trace it on each end and cut to proper shape. Complete the tips by sandpapering their cut edges smooth.

In the plans under "Wing Assembly" will be seen the shape of the wing, which



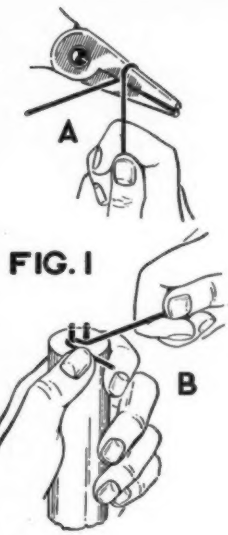


FIG. 1

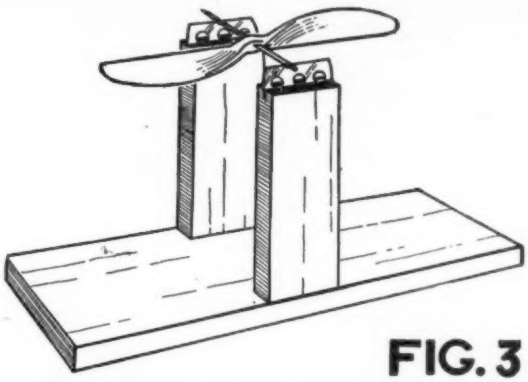


FIG. 3

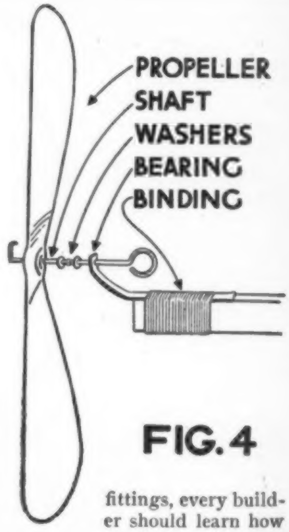


FIG. 4

JUNIOR MODEL AIRPLANE BUILDERS CONTEST

Here is a chance to use your craftsmanship to advantage and win one of the five monthly awards. This is all you have to do to enter the contest:

Build the model described in each one of these monthly articles. Photograph it or have it photographed and send the photographic prints to the Editor, **Universal Model Airplane News,** with a written description of what you thought the most difficult operation in the building of the model and how you overcame it.

This contest will run for five months. It will begin with the model appearing in the May issue and will end with the model appearing in the September issue of this magazine.

The five best sets of photographs and discussion of each model will be chosen by the judges from those submitted and an award of five dollars will be paid to each one of the contestants for each winning entry that they submit.

The winning entries will be selected on the following basis:

Accuracy and neatness of the model as judged from the photograph, the quality of the photograph itself, and the comprehensiveness of the discussion and the neatness of presentation of the entry.

Those who will act as judges are: Mr. George C. Johnson, publisher; Mr. Edwin T. Hamilton, author; and Mr. Charles H. Grant, editor.

Plans and instructions for building four models have been published. The first one was in our May issue, the second in our June issue, the third in the July issue, and the fourth in this issue of **Universal Model Airplane News.**

Get busy on the model now, for all entries for model No. 2 must reach this office by midnight of Monday, July 16. Entries for model No. 3 must reach this office before midnight of Wednesday, August 1st, and entries for model No. 4 must reach this office before midnight, Friday, August 31st.

No entrant will be eligible for an award unless he truthfully states he has built the model himself and give his correct age and address. Give this information at the end of your discussions and have your parent or guardian sign it as a witness.

This may be the start of your career in aviation. Get busy now. Send all entries to Charles H. Grant, editor, **Universal Model Airplane News,** 531 Fifth Avenue, New York City.

must now be given it with the aid of sandpaper. Follow the instructions for this work given in the June issue on Pages 9 and 36. When completed, the wing is given its dihedral angle. Note this in the plans under "Wing." Each tip is given a 2" dihedral. (See June issue, Page 36—Fig. 3).

The wing mounting is now made. This is shown under "Wing Assembly." It consists of two sides, a mounting stick and a separator. The sides are made first. Both may be cut from a single piece of sheet balsa measuring 1/32" thick, 2½" wide and 4" long. Their grain must run up and down when assembled under the wing, as shown in the plan. As the wing is set with its leading edge 3/32" higher than its trailing edge, these pieces forming the wing mount must be 3/32" longer, or higher, at the front than at the back. Note that their top width is only 2" while they are 2½" along the bottom. Cut one of these side pieces perfectly and then make a second duplicate piece. Test them by placing one on top of the other and seeing if all sides of both match perfectly.

A 3/16" square balsa stick is cut 5" long, as shown in the plans. Both of its ends are tapered along the top from its original thickness of 3/16" to 1/16". The front taper begins 1⅛" back from the front end and the rear tapering begins 1⅜" back from the back end. A second stick is cut of the same size balsa stick, but is only 2" long. This is used to separate the side pieces at the top and is shown in dotted lines. Its ends are beveled, as shown.

The entire mounting is now assembled. Cement the long balsa stick between the side pieces with its bottom edge parallel with the bottom edges of the sides. Note that it extends out 1⅛" at the front of the side pieces and 1⅜" at the rear, and that it is located ¼" above the bottom edges of the sides. The short stick is cemented between the sides along their top edges, so that the top edge of the stick and those of the sides are flush. The wing is mounted on this assembly, as shown in the plans under "Wing" and "Wing Assembly." The top of the sides and their separating stick must be slightly grooved to fit the slant of the wing's center joint. (See June issue, Page 10, under "Wing").

Cement the wing in place so that its center joint comes in the exact center of the sides of the elevation assembly, as shown by the front view of the "Wing." See that both wing tips are exactly the same height above the center assembly.

Metal Fittings

All power-driven model airplanes require a certain number of metal fittings. Most of these are bent from wire. While the majority of model supply houses carry a full line of "standard" shapes in metal fittings, every builder should learn how to bend his own from straight wire so as not to be dependent on the manufactured article.

As weight is one of the most important factors in model work, a very thin wire must be used to keep it at a minimum. At the same time, it must possess the required strength. Piano wire has been found to produce the greatest strength with the least weight and is universally used by model builders. It may be purchased at any model supply store.

The size or diameter of wire is measured with a wire gauge. Each diameter is specified by a number and when ordering wire, the purchaser should not only order "piano wire" but must name the desired number. As it is well for the beginner to know something of wire diameters and their numbers, a few of the most commonly used are given here:

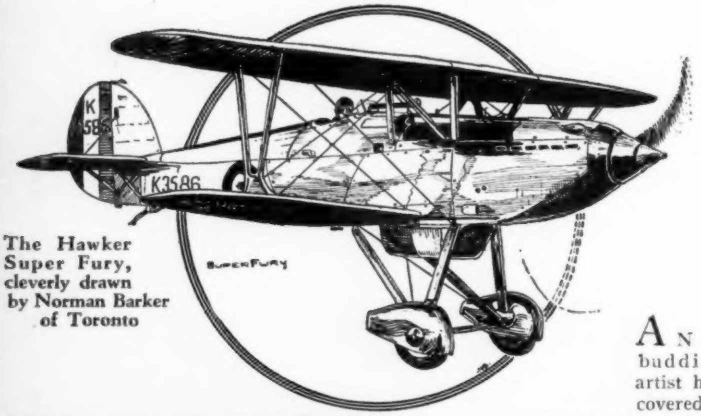
Gauge No.	*Wire Diam.*	*Gauge No.*	*Wire Diam.*
5	0.014"	11	0.026"
6	0.016"	12	0.0283"
7	0.018"	13	0.031"
8	0.0197"	14	0.033"
9	0.022"	15	0.035"
10	0.0236"	16	0.037"

While only about 6" of wire is necessary for this model, surplus wire of various sizes should be kept on hand. The fittings of this model are bent from No. 14 piano wire. Bending wire requires time and practice. Do not feel discouraged if your first attempts should fail because when once mastered, any fittings may be made with ease.

Special wire cutters should be purchased, as piano wire will ruin an ordinary pair of pliers in a short time. Round-nosed pliers should be used for bending this wire, and two pairs will be found useful. While one holds the end of the wire, the second can do the bendin. Note Fig. 1-"A." This

(Continued on page 36)

FIG. 5



The Hawker Super Fury, cleverly drawn by Norman Barker of Toronto

AIR WAYS
HERE AND THERE
What Readers Are Doing to Increase Their Knowledge of Aviation in All Parts of the World. Send Pictures and Details of Your Experiments

ANOTHER budding young artist has been discovered. He is Norman Barker of 139 Evans Avenue, Toronto, Ontario, Canada, and is responsible for the very artistic drawing of the Hawker Super Fury which heads our Air Ways column. We will look forward with great pleasure to presenting more of Barker's work.

This month we have some big news and some interesting snapshots which were taken at the Eastern States Model Airplane Meet held at Newark Airport on Saturday, May 19th. This contest was sponsored by UNIVERSAL MODEL AIRPLANE NEWS and the Bamberger Aero Club. It was an official meet held under a National Aeronautic Association sanction.

For the first time in the history of model aviation in this country, more than two contestants entered gasoline powered models. This type of ship was the "hit" of the meet and stole the show from its rubber powered little brothers.

The day for the contest dawned clear, but hot and mucky. Contestants began to assemble as early as eight o'clock, and by the middle of the morning there were about two hundred contestants and an additional three hundred spectators watching the many unique ships brought from various cities of the East. Due to the unexpectedly large attendance, there was some delay and confusion in getting the flying groups started. However, this was finally accomplished. Everything was going fine when contestants, judges and spectators took notice of the several gas jobs which were tuning up. The contest practically stopped right then and there for a considerable period, for these little ships disorganized matters more than an army of tanks could have done. Movie camera men and photographers were busy. They considered this event exceedingly unusual and the builders of the ships were not at all adverse to a little publicity.

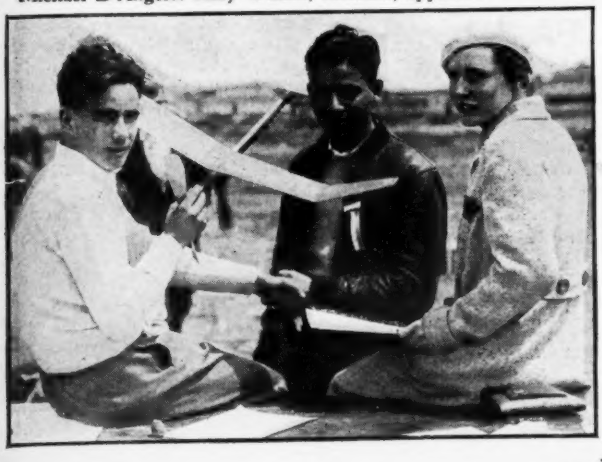
The honor of starting the ball rolling goes to Joseph Kovel, for he was the first one to fly. The others seemed to hold back in order to see what their competitors were going to do. However, if you have a good ship there is no use waiting around.

After warming his engine up, Joe's plane taxied over the group for a short run and took to the

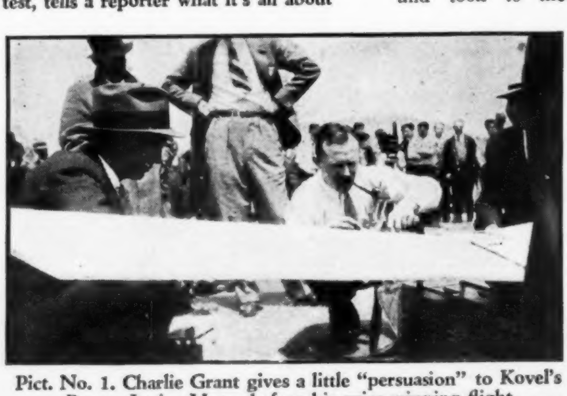
Pict. No. 4. Ludwig Bielko lets his motor warm up before a flight. The plane unfortunately crashed

Pict. No. 3. Alfred Huber tunes up his gas job

Pict. No. 6. Irwin Polk, a director of the contest, tells a reporter what it's all about



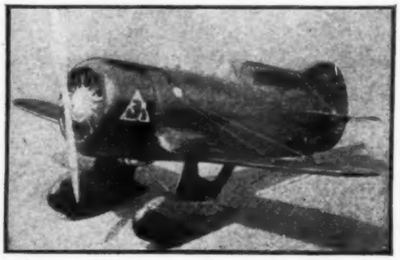
Pict. No. 5. Phil Zecchitella, timer, congratulates Michael D'Angelo. Mary Walker, recorder, approves



Pict. No. 1. Charlie Grant gives a little "persuasion" to Kovel's Brown Junior Motor before his prize winning flight

Pict. No. 9. A flying scale Boeing 247 built by Orval Lloyd, a beautiful job

Pict. No. 8. Miss Barbara Maschin, the only girl contestant, displays her excellent twin pusher. She is an expert



Pict. No. 14. Jack Coppages' scale Gee Bee which won 1st. prize in Atlanta, Ga., contest

Pict. No. 7. John Haw anxiously awaits a decision by Mr. Zecchitella about correct wing loading

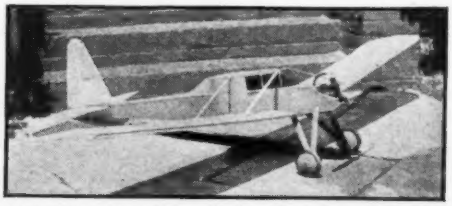
air, climbing steeply in wide circles. It was unfortunate that at the start of the flight the ship got into an air-pocket, which threw it around in a very erratic manner and afforded great excitement for the crowd, for several times it looked as if the machine was going to dive right into the spectators. Finally the ship struck an upward air current and began to climb on a level keel. It rose quickly to an altitude of about seven to eight hundred feet, when the gasoline ran out and it started to glide. The glide afforded many thrills, for Joe through some mistake, had miscalculated his thrust line and thereby the stabilizer setting. This caused the plane to zoom after it had glided to about one hundred feet from the ground. The zooms continued, increasing in violence until the last one carried the plane into the marsh. The soft ground saved the ship from being badly damaged. As it was, the only thing that was broken was the propeller and the center section struts. The time was four minutes, thirty-five seconds. About three-eighths of an ounce of gas was used which was less than one-half the amount which could have been used under the rules of the contest. The reason for this was that Joe received advice to be a little cautious and spare himself the misfortune of having the model fly into nearby Newark and crack up beyond repair. This would have eliminated Joe from the National Contest at Akron.

Pict. No. 12. Ohlsson watches expectantly as his gas plane takes off into flight

Picture No. 1 shows Joe's gas job being tanked up for the flight by your editor. Joe was in the picture though all that can be seen of this modest young man is the leg of his trousers, which appears at the extreme right. At the left a movie camera man is anxiously awaiting the chance to take a "shot" of the plane.

After studying air conditions carefully, Maxwell Bassett of Philadelphia prepared his gas job to "do its stuff." He was wise enough to note the position of the rising air current and made his take-off in a location that would assure the best results for his plane. The little ship rose very steeply and climbed like a rocket, gaining an altitude of about sixteen hundred feet. As predicted, the wind and the full gas supply carried Bassett's ship well over the city of Newark. Here it was lost to the view of the spectators in the haze. The time was six minutes, seven and one-fifth seconds.

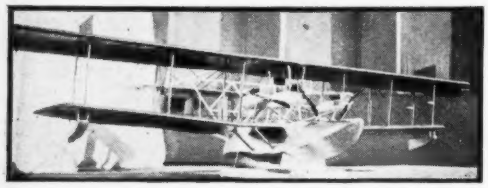
Most of the observers and



Pict. No. 10. One of the first low-wing gas "buggies" to appear, built by Henry Hughes

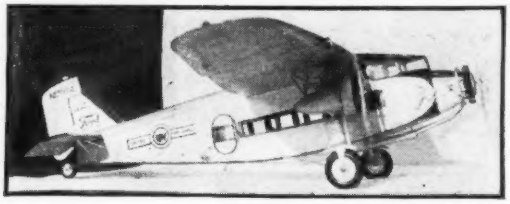
Pict. No. 11. Here is a real performer. Irwin Ohlsson and his 8 ft. gas model

Pict. No. 2. Maxwell Bassett with his plane with which he won first place in the Gas Powered event of the Eastern States Outdoor Contest, held recently at Newark Airport. It flew for 6 min., 7 1/5 sec.



Pict. No. 15. An N.C.-4 model, in complete detail, by William T. Howell

Pict. No. 13. A detail scale Ford Tri-motor, built by Henry Garttmeyer



timers feared the worst regarding Bassett's ship. However, he was exceedingly fortunate, for an air-minded young man had taken it into his back-yard intending to keep it as a souvenir. The plane was quite badly smashed. Under the conditions, Bassett was fortunate in retrieving any part of it.

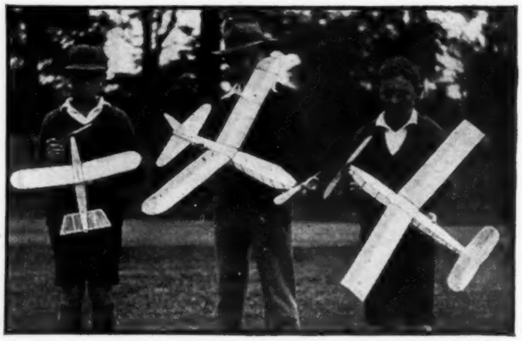
Picture No. 2 shows Bassett during the contest holding the winning model. The usual group of airplane "satellites" in the form of youngsters of about ten to twelve years of age are in the background. The interest and enthusiasm of these young men is to be admired, but under certain conditions, especially around delicate airplanes, it is to be regretted; for they were the cause, in several instances, of some badly smashed planes. One young photographer let his camera drop directly on Joe Kovel's gas job wing. Luckily, the wing was strong or else the camera was too light to do much damage. It was easily repaired.

The other contestants in the gas engine event were not very successful. One of the members of the Bamberger Aero Club, Alfred Huber, had prepared a cabin gas job, which is shown in picture No. 3, with its builder busily trying to eliminate the "bugs" from the engine. The ship got off the ground and flew for eleven seconds, when unfortunately is succumbed to the forces of gravity and cracked up.

Ludwig Bielko and Ben Shereshaw also entered gas jobs, but did not succeed in making a flight. Bielko's plane did a terrific swoop and cracked up on a sharp turn after getting off the ground.

The little gasoline motors driving these craft were of extreme interest. They were powered by two types of one cylinder engines, the Brown Junior Motor engine and the Loutrel engine. The winning models all used the Brown engine.

Pict. No. 16. Don Sogard and his friends have some exciting moments flying his 43 in. Yellow Bird "low-wing"



Pict. No. 19. When these young fliers from Concord, N. S. W., Australia fly big ships, they will know about them

Ludwig Bielko and his model are shown in picture No. 4.

There were two other events; the Fuselage Endurance and Stick Endurance. The winners of the Fuselage contest, in the order in which they placed, were:

Fuselage Endurance

Michel Lichstein—6:52-3/5
August Ruggeri—2:00
Neil George—1:54
William Sherwood—1:40
Victor Bohoen—1:38
Joseph Hoffman—1:37-2/5

Stick Endurance

Bruno D'Angelo—8:29-2/5
Frank Ehling—5:41
August Ruggeri—4:22
Herbert Greenberg—3:50-2/5
George Aspiotis—3:41-2/5
Dannie Clini—3:27-1/5

Photographers have a bad habit of never being around when you want want them, so the best we could do in regard to getting pictures of the winners was to get a picture of Michael D'Angelo, the brother of Bruno D'Angelo, who won the Stick Endurance event. Michael placed will up toward the top of the list. He is shown in picture No. 5, shaking hands with Phil Zecchitella, timer. Mary Walker, the secretary of the Bamberger Aero Club, is shown at the right greatly interested in the proceedings.

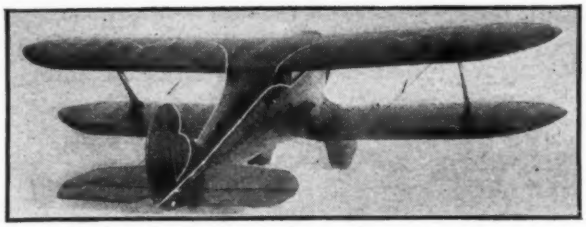
Picture No. 6 is especially interesting for one reason. It shows one of the oldest model builders in the country; by this we do not mean old in age, but old in experience. He is Percy Pierce and is shown in the center of the picture, in the background. He always was of a retiring nature, except when it came to winning first place in a contest of pioneer days. It is interesting to know that Percy won a distance event in a contest held by the Bamberger Aero Club in Newark on May 18, 1912. Twenty-two years later, almost to the day, he officiated at another Bamberger contest at Newark Airport.

A judge and one of the directors of the Meet, Mr. Irwin Polk, is shown in the center of the picture wearing a straw hat. He is trying to prompt a reporter what to say about the contest and we have a slight suspicion that a word or two for the Bamberger Aero Club was suggested. More power to him. The reporter on the left with the notebook seems to be taking

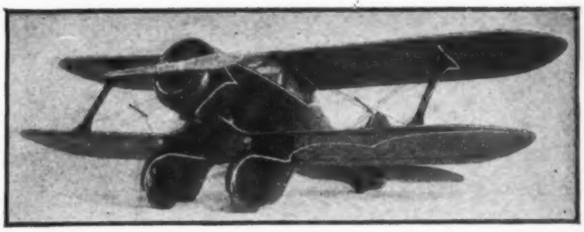
(*Continued on page 44*)

Pict. No. 17. Mr. A. Catts, Vice-Pres. of M.F.C.A. presents the Percy Marks Cup to Russell Jackson for winning three contests

Pict. No. 18. Model planes are "on the air" and in the air for the first time. Russell Jackson demonstrates for radio listeners



The completed model ready to fly. Span 20"



It is characterized by accuracy of detail. Wt. 1¾ oz.

Build a Flying Model Beechcraft

How You Can Build a Model of a Unique Commercial Plane That Will Give Fine Performances

By R. V. GROVER and F. T. ROBERTS

THE model given here is a scale model of the Beechcraft, a new biplane having negative staggered wings. The large ship is exceptionally well streamlined and the model faithfully duplicates this feature. The model is a fast flier and very rugged, the test model making over fifty flights before a weak I-strut broke. Five or six flights later, a hard landing fractured a wing spar.

The order of construction as given here, while unconventional, has been carefully worked out to allow use of the plans to the greatest advantage. Do not cut out any patterns unless the written instructions so indicate; all others should be traced on thin paper and pasted to light cardboard, then cut out for patterns. If all instructions are followed, there will be no part of the drawings cut up that will be needed in future construction of the model.

This ship when at rest has a very large groundangle which helps, from a standing R. O. G. start, to get the model off the ground within four feet (with only 100 winds in the motor).

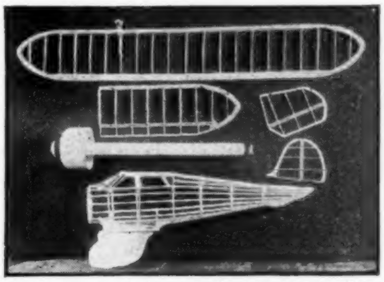
Wing (Plate No. 1)

Construction should begin with the wings, due to the fact that the bulkheads for the fuselage, printed on the reverse side of the page, must be cut out after the wings are built.

Begin the top wing by tracing right half from the left half given and joining at the center line. Now trace rib pattern No. 1 and cut fifteen from 1/32" balsa and two from 1/16" balsa. Next trace rib patterns No. 2 and No. 3. (Do not cut rib patterns from drawings as this will spoil bulkhead patterns).

Cut four of each of these ribs from 1/16" stock, two of each of these are to be used for the bottom wing.

Place the whole wing layout on a smooth board with waxed paper over it to prevent the finished wing from sticking. Pin leading and trailing edges in place and glue in ribs, leaving the center rib out. (Note position of the two No. 1 1/16" thick ribs).



The uncovered framework shows clean lines and strength

Cut, tracing patterns first, the wing tips from 1/8" stock. These are fastened in place with a 7/32" block under the tip and with the top of wing tip piece even with the top of the leading edge. Glue rib No. 2 in place with a 3/32" block underneath and No. 3 ribs with a 5/32" block. The top of the wings should be level, all taper of the tips being on the bottom of the wings. A ruler laid across the ribs at their highest point should touch all ribs and the outer point of the tips.

When wing is dry, sandpaper wing tips and leading and trailing edges to shape. (A small block-plane when handled right, is fine for shaping leading and trailing edges. Now cut at center line for dihedral. Place a 7/32" block under each outer No. 1 rib and glue spars (leading and trailing edges(at center. Glue center rib in at this time. When first coat is dry, give this joint a coat of cement.

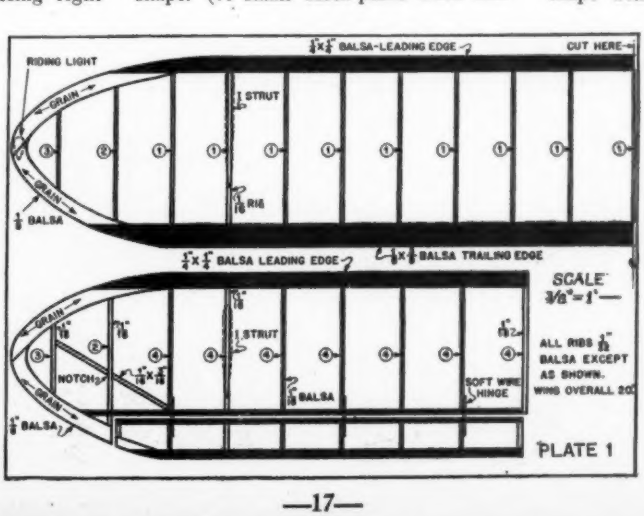
Bottom wings are constructed in like manner with the addition of an aileron, the construction of which is clearly shown. Leave these wings in separate halves as they are joined to fuselage after its completion.

At this time, construct details shown on Plate No. 3 as Plate No. 4 must be cut to join side view of fuselage. You will find that building these details now will seem to hasten construction later.

Pants (Plate No. 3)

Trace outline of pant core and cut four from 1/8" medium hard balsa. Glue together in pairs. Trace and cut pants' sides from same balsa. Glue sides to core as shown, first slightly hollowing the sides to give wheel clearance. Pants are now cut and sanded to streamline shape, sand smooth, give a coat of banana oil and again sand smooth. They are now covered with tissue.

Cut front discs and sides of landing lights shown on pants drawings, from 1/16" stock. Glue to pants as shown and shape with knife and sandpaper. After model is colored, a disc of silvered paper is glued to front of lights to give a realistic appearance.



Wheels

Wheels are made of pine or other hard wood. The weight of these balance the model. (The test model balanced exactly right without other weights when pine wheels were put on in place of the balsa ones first tried). Fasten wheels in pants, after doping black with red centers, using short pieces of No. 12 music wire for axle Tail wheel is cut from 1/8 balsa sanded to shape. D black.

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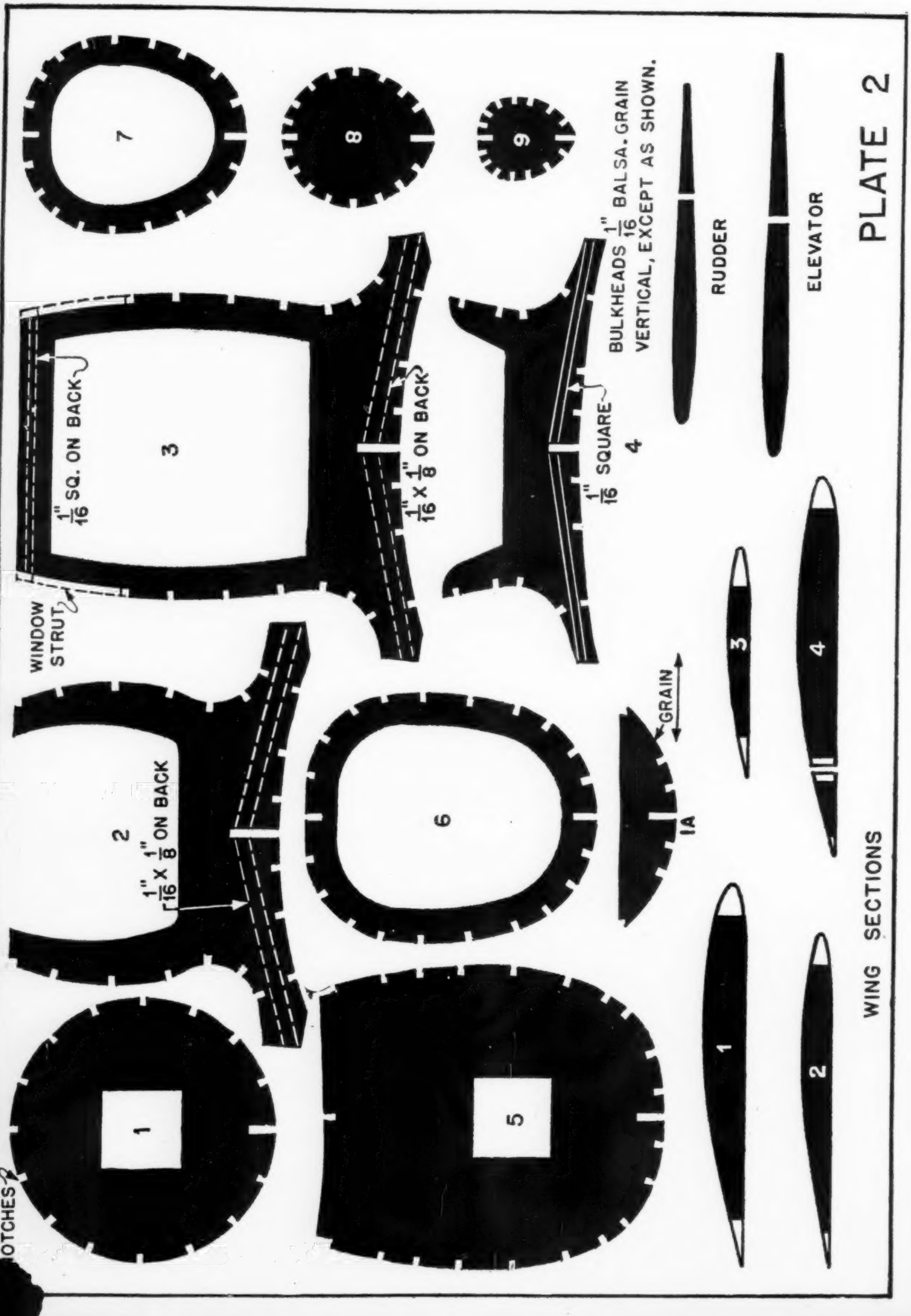


PLATE 2
BULKHEADS 1/16" BALSA. GRAIN VERTICAL, EXCEPT AS SHOWN.
1/16" SQ. ON BACK
1/16" X 1/8" ON BACK
1/16" SQUARE
1/16" X 1/8" ON BACK
WINDOW STRUT
GRAIN
1A
NOTCHES
RUDDER
ELEVATOR
WING SECTIONS

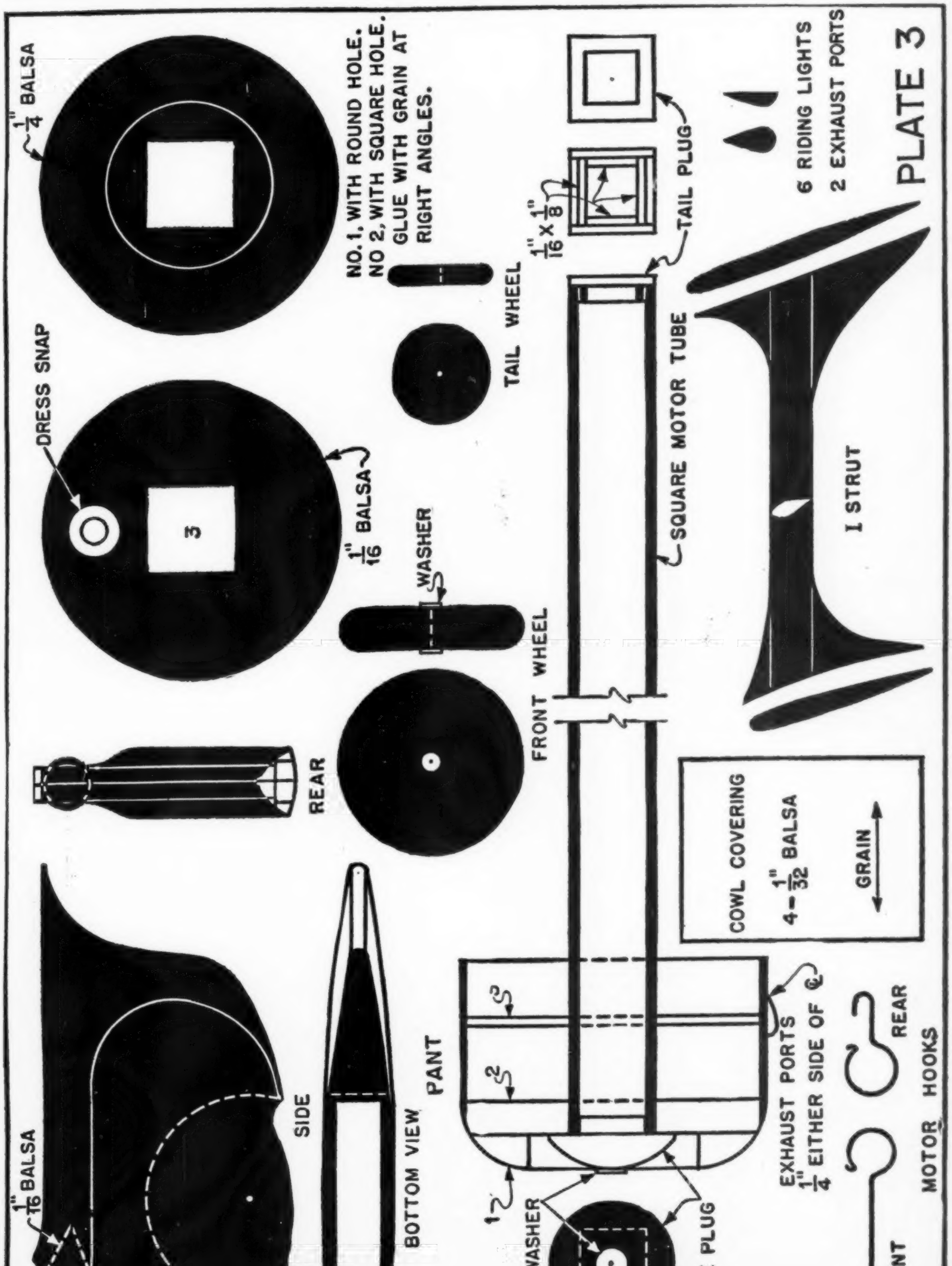


PLATE 3
$\frac{1}{16}$" BALSA
SIDE
BOTTOM VIEW
REAR
DRESS SNAP
3
$\frac{1}{16}$" BALSA
$\frac{1}{4}$" BALSA
NO. 1, WITH ROUND HOLE.
NO 2, WITH SQUARE HOLE.
GLUE WITH GRAIN AT
RIGHT ANGLES.
WASHER
FRONT WHEEL
TAIL WHEEL
SQUARE MOTOR TUBE
$\frac{1}{16}$" X $\frac{1}{8}$"
TAIL PLUG
6 RIDING LIGHTS
2 EXHAUST PORTS
I STRUT
COWL COVERING
4 - $\frac{1}{32}$" BALSA
GRAIN
PANT
3
2
1
WASHER
NOSE PLUG
EXHAUST PORTS
$\frac{1}{4}$" EITHER SIDE OF ℄
MOTOR HOOKS
FRONT
REAR

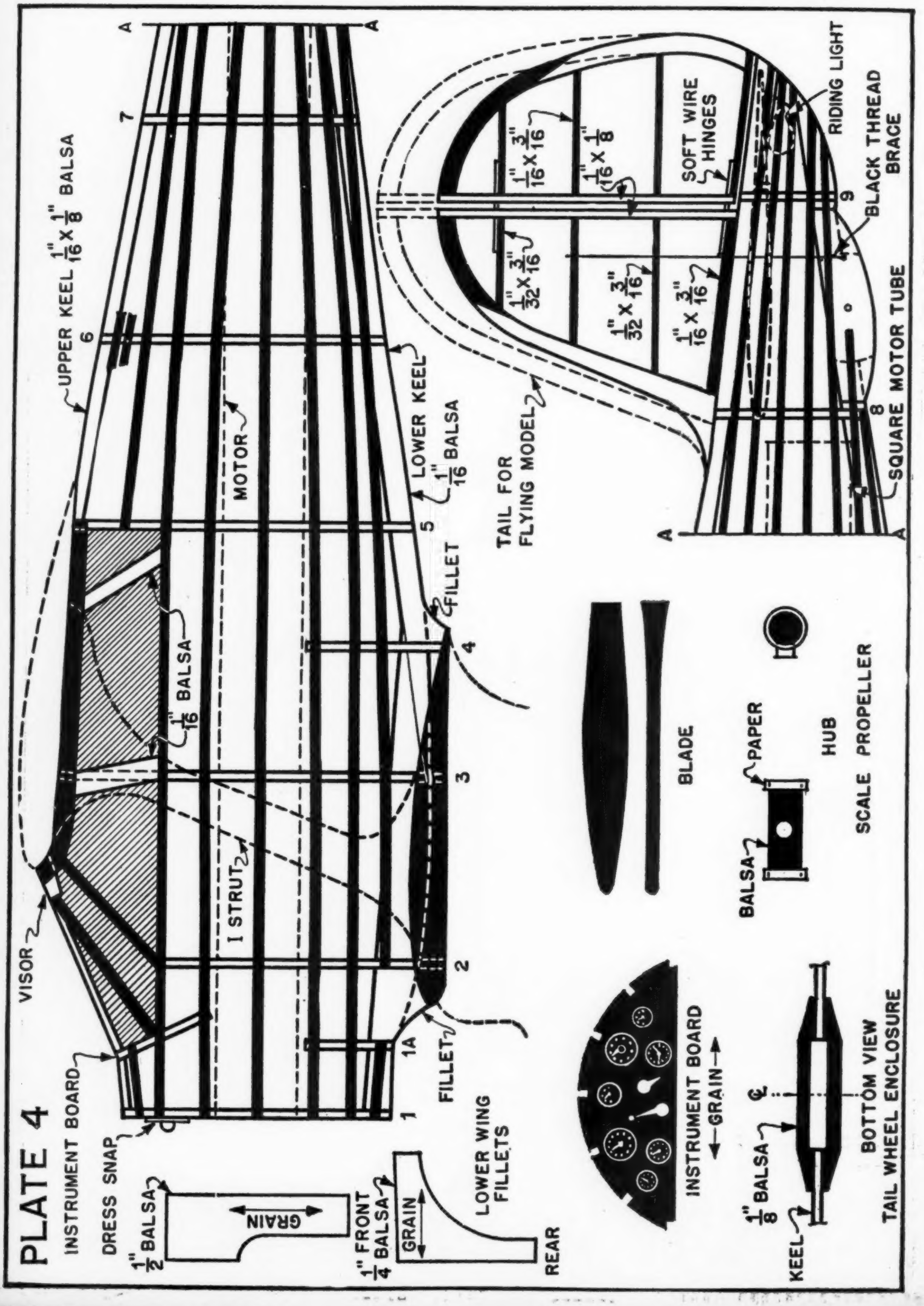


PLATE 4
INSTRUMENT BOARD
DRESS SNAP
1/2" BALSA
GRAIN
1/4" FRONT BALSA
GRAIN
LOWER WING FILLETS
REAR
FILLET
1A
1
2
3
4
5
6
7
VISOR
I STRUT
1/16" BALSA
UPPER KEEL 1/16" X 1/8" BALSA
MOTOR
LOWER KEEL
1/16" BALSA
FILLET
A
TAIL FOR FLYING MODEL
1/32" X 3/16"
1/16" X 3/16"
1/16" X 1/8"
SOFT WIRE HINGES
RIDING LIGHT
BLACK THREAD BRACE
SQUARE MOTOR TUBE
8
9
BLADE
PAPER
BALSA
HUB
SCALE PROPELLER
INSTRUMENT BOARD
←GRAIN→
1/8" BALSA
KEEL
BOTTOM VIEW
TAIL WHEEL ENCLOSURE

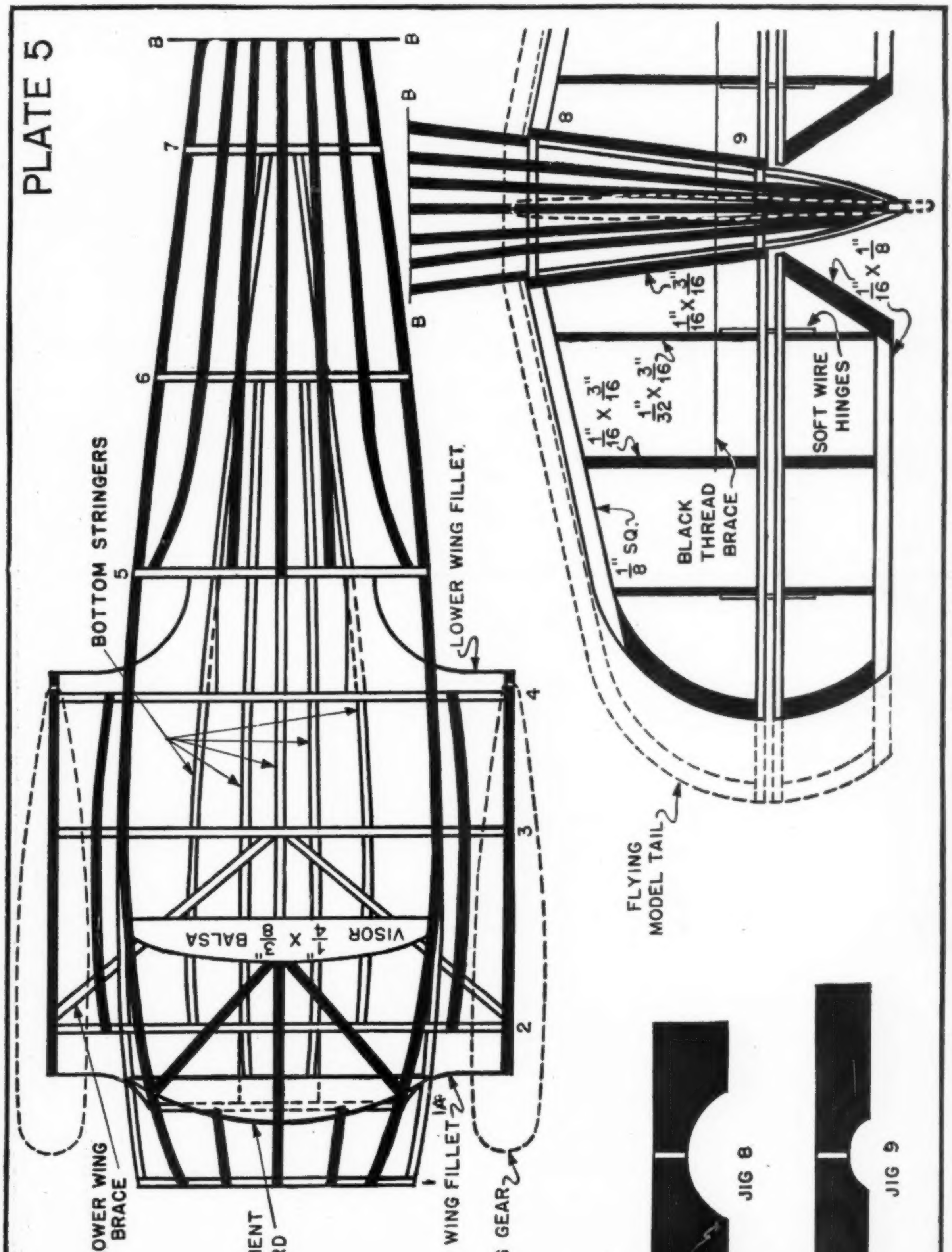


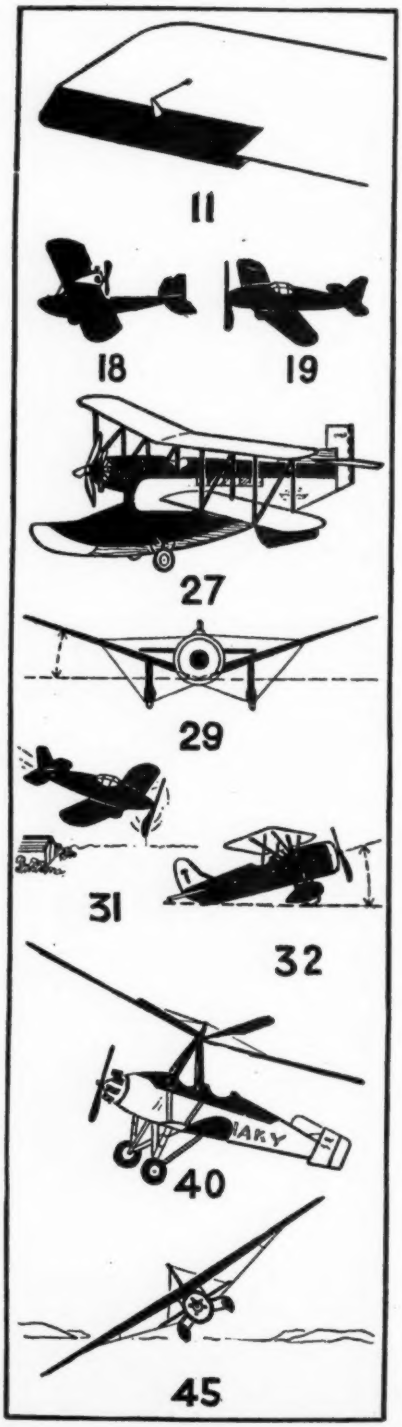
PLATE 5
BOTTOM STRINGERS
LOWER WING FILLET
1/16" X 1/8" LOWER WING BRACE
INSTRUMENT BOARD
LOWER WING FILLET
LANDING GEAR
VISOR 1/4" X 3/8" BALSA
FLYING MODEL TAIL
1/8" SQ.
1/16" X 3/16"
1/32" X 3/16"
BLACK THREAD BRACE
1/16" X 3/16"
SOFT WIRE HINGES
1/16" X 1/8"
JIG 8
JIG 9

Illustrated Aviation Dictionary

Many model builders and other readers are often in doubt with regard to the meaning of common aeronautical words. A number of them will be defined each month, therefore, in order to give readers a larger scope of understanding.

By EDWIN T. HAMILTON

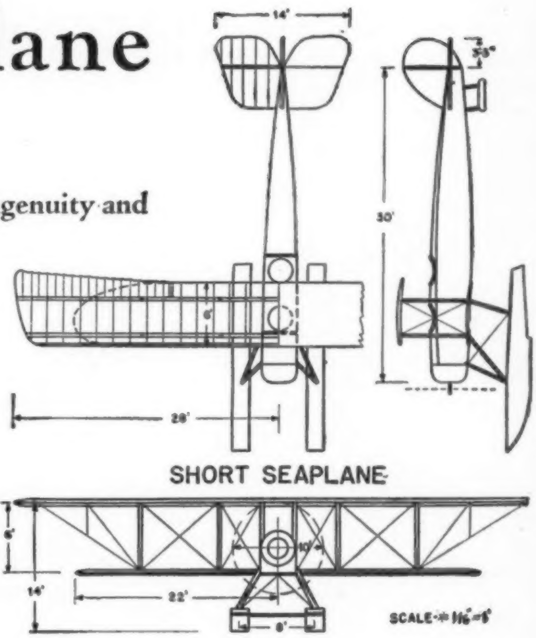
1. **AERIAL.** Of or like the air. Atmospheric. High in air. Above earth.
2. **AERO.** Pertaining to air.
3. **AERODONETICS.** The science pertaining to climbing or soaring flight.
4. **AERODYNAMICS.** That branch of dynamics which treats of the laws of motion of the air and other gaseous fluids in connection with gravity and other mechanical forces.
5. **AEROGRAPHY.** A written study of the atmosphere and its phenomena.
6. **AEROIST.** One versed in aircraft.
7. **AEROMECHANICS.** Same as *aerostatics* and *aerodynamics.*
8. **AERONAUT.** Same as balloonist or *aviator.*
9. **AERONAUTICS.** The art and science pertaining to the flight of aircraft.
10. **AEROPLANE.** Same as *airplane.*
11. **AILERON.** A hinged or pivoted, movable, auxiliary surface of an aircraft, usually part of the trailing edge of each wing. Its function is to cause a rolling movement of the plane about its longitudinal axis. It also gives side-to-side control to the plane.
12. **AILERON CONTROL HORN.** See *horn, aileron.*
13. **AIRCRAFT.** A general term used for any and all airplanes, balloons, diribles, etc. Any device or structure which will carry weight, designed to be supported by the air, either by buoyancy or dynamic action.
14. **AIRDROME.** A landing field for airplanes.
15. **AIRFOIL.** Any surface of an aircraft designed to be propelled through the air in order to produce a directional or lifting effect.
16. **AIR-MINDED.** Interested in aeronautics. Desiring knowledge of aeronautics.
17. **AIRPLANE.** A heavier-than-air machine, mechanically driven, which is fitted with fixed wings and supports itself in the air by its own power. It may have any number of wings.
18. **AIRPLANE, PUSHER.** An airplane which has the propeller or propellers behind or at the rear of the main supporting surfaces. Aircraft with pusher propellers.
19. **AIRPLANE, TRACTOR.** An airplane which has the propeller or propellers in front of the main supporting surfaces.
20. **AIR-POCKET.** Same as *pocket.*
21. **AIRPORT.** A locality either on water or land, which is adapted for the landing and taking off of aircraft and which provides shelter, supplies and repairs for aircraft. A place used regularly for receiving or discharging passengers or cargo by air.
22. **AIR SPEED.** The speed of aircraft relative to the air through which it is passing.



23. **AIR SPEED INDICATOR.** An instrument so designed as to indicate the speed of an aircraft relative to the air.
24. **AIRWAY.** An air route between air traffic centers. An airway is mapped out over ground on which there are good landing-fields, airdromes, etc., for the convenience of flyers.
25. **ALTIMETER.** An instrument which indicates the height of an aircraft above sea level.
26. **ALTITUDE.** Any height above land or water.
27. **AMPHIBIAN.** A plane equipped for taking off from and landing on both land and water.
28. **ANGLE OF ATTACK.** The acute angle of the chord of the main supporting surface of an aircraft to its direction of motion relative to the air.
29. **ANGLE, DIHEDRAL.** This is obtained by inclining the main wings of an airplane up from the center of the fuselage so that the tips are higher than any other portion of the wings. This angle is measured from the chord of the wing to a line drawn horizontally through the point of intersection of the two wings, if they were elongated equally at the fuselage until they met.
30. **ANGLE, ELEVATOR.** The angular displacement allowed in the setting of the elevator from its normal position with reference to the line of thrust.
31. **ANGLE, GLIDING.** The angle of flight of an aircraft when gliding down preparatory to landing.
32. **ANGLE, GROUND.** The acute angle between the longitudinal axis of an airplane and the horizontal when the plane is resting in its normal position.
33. **ANGLE, LONGITUDINAL DIHEDRAL.** The difference between the angle of wing setting and the angle of stabilizer setting.
34. **ANGLE OF STABILIZER SETTING.** The acute angle between the line of thrust of a plane and the chord of the stabilizer.
35. **ANGLE OF WING SETTING.** The acute angle between the line of thrust of an airplane and the chord of the wing. (Angle of incidence.)
36. **ANGLE OF YAW.** An angular deviation of an aircraft from its course, along the fore-and-aft axis.
37. **ANTIDRAG WIRE.** A wire, usually inclosed in the wing, designed to resist forces acting parallel to the chord of that wing and in the same direction as that of the flight.
38. **ANTILIFT WIRE.** Same as *landing wire.*
39. **AREA, WING.** See *wing area.*
40. **AUTOGIRO.** A form of airplane whose support in the air is maintained by freely revolving surfaces about vertical

(Continued on page 46)

How the Aeroplane Was Created



SHORT SEAPLANE

SCALE—1/16"=1'

How the War Fanned the Flames of Aeronautical Ingenuity and Produced Sensational Developments in All Types of Airplanes

PART NO. 8

By DAVID COOPER

FROM the earliest days of the aeroplane, even before it became an actual practicality, it seems that many with diabolical foresight, saw in it not only a vehicle for commerce but also an instrument for warfare. Even long years before the advent of the flying machine, Alfred Lord Tennyson wrote of the "nation's aerial navies grappling in the blue," and others, such as Jules Verne, wrote of marvelous devices capable of negotiating long distances by air with efficiency and dispatch.

There must have been some inkling in the minds of men of the destruction which could eventually be wrought by the aerial navies, for at the Hague Peace Conference in 1899, the members seemed to have some intuitive fear and decreed that no aircraft be used for war purposes; but at the 1907 conference, with the flying machine an already practical device, nothing was said pertaining to it. Thus, despite the apparent facts as generally seen, the nation probably felt that in case war *did* come, these machines could be used as the eyes of hidden gunmen, to improve or perfect their marksmanship. Even during the Civil War, balloons were used to spy out the enemy movements and to direct gunfire.

Up to the time when the smouldering fires in Europe burst into a conflagration in 1914, the aeroplane had been used entirely as a means of sport, notwithstanding some slight attempts at commercialization. Figures show that France had fifteen hundred, Germany one thousand and Great Britain eighty-two aeroplanes, with no branch of the national defenses equipped with machines, except of an experimental nature. The first official attempt at such an organization came with the inception of the Royal Naval Air Service in England, in September 1914, and England having been drawn into the conflict they were based as soon as possible at Ostend in Belgium.

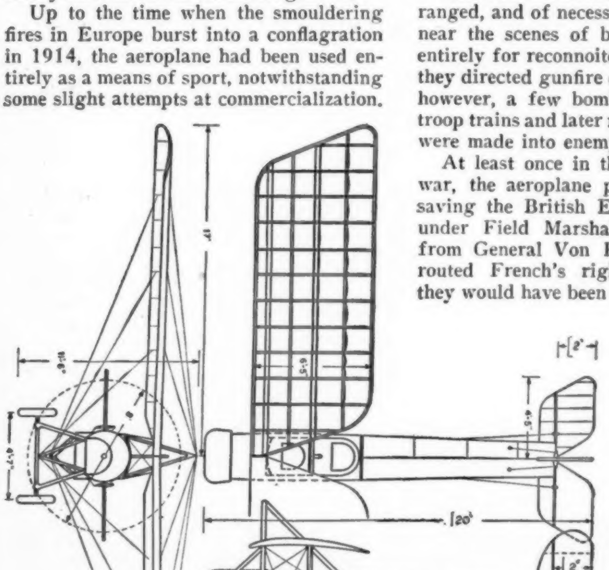
Other nations, such as Italy, Russia and Austria Hungary had a few factories producing aeroplanes under patents from France, England and Germany but for the most part they were rather insignificant, with the possible exception of the Italians. Immediately it was seen that the aeroplane could be a means of both offense and defense the nations commandeered these factories, and every effort was made to turn out machines in standardized quantities.

All of the aircraft of course, were short-ranged, and of necessity had to be billeted near the scenes of battle and were used entirely for reconnoitering. By signalling, they directed gunfire on the ground. Soon, however, a few bombs were dropped on troop trains and later more extended flights were made into enemy territory.

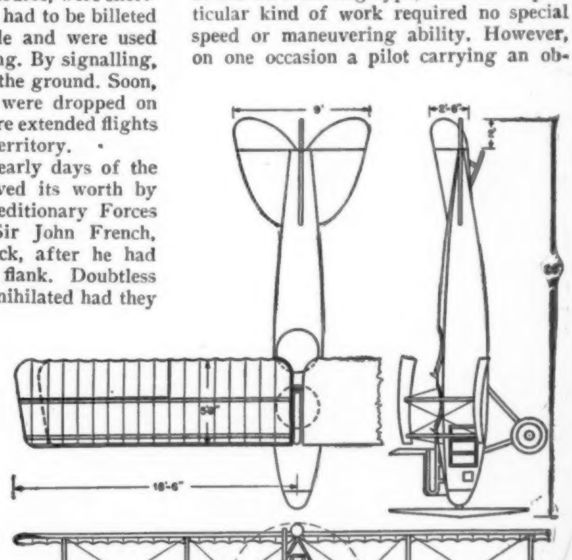
At least once in the early days of the war, the aeroplane proved its worth by saving the British Expeditionary Forces under Field Marshal Sir John French, from General Von Kluck, after he had routed French's right flank. Doubtless they would have been annihilated had they been forced to depend on the slow-moving cavalry to dispatch information. The aeroplanes flying overhead noted the change in maneuver and quickly notified French's forces, with the result that he was able to counter the German move and thereby save himself.

In September 1914, Immelman, later a famous German flyer struck terror into the hearts of the French by flying low over Paris, dropping a message calling upon them to surrender and sagaciously informing them that Germany was even then about to enter the city.

Practically all the aeroplanes used were of the slow-moving type, since their particular kind of work required no special speed or maneuvering ability. However, on one occasion a pilot carrying an ob-



MORANE SAULNIER PARASOL



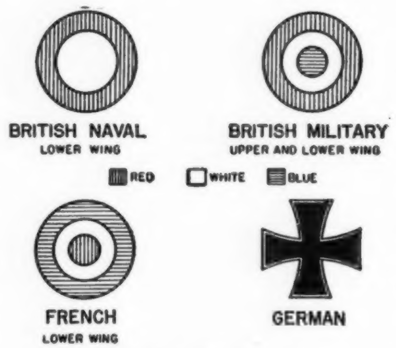
ALBATROSS-1915

SCALE—3/32"=1'

server, had the temerity to carry a large rock, which was heaved with unerring accuracy at his enemy, splintering his propeller and causing him to crash. Thereafter the personal element entered the conflict in the air. Then came the use of the pistol in the air and later the mounting of the machine-gun.

France of course, was depending mainly upon such well-known machines as Farman, Bleriot, Voisin, Breguet and Deperdussin, and generally for the kind of service demanded from them in the early months of the war, they did fairly well; but before many months had passed, it was determined that the aeroplane had more to do than simply observe and act as message-bearer. Actual combat work between enemies called for a faster machine, one capable of overtaking the enemy, flying higher and generally out-maneuvering him, and of course this all required better construction and more durable materials.

Out of these changes came much improved flying machines with provisions for carrying a pilot's observer, who operated a gun or took photographs of the enemy terrain. Let us see what these changes did to the French group. Among those of the older manufacturers who survived the stringent new government regu-



WING IDENTIFICATIONS

lations were Farman, Bleriot, Caudron, Breguet, most of the others being subsidized by the French government. The Deperdussin factory having made a few training planes, found itself in financial difficulties and was taken over and operated under a good receivership, the new concern bearing the title "Societe Pour les Appariels Deperdussin." The letters of this name made up the name SPAD and their products were of the highest order and of world renown.

Farman's newest model under these changes was an excellent type of seaplane for use in conjunction with the navy. Other Farmans and Caudrons were built for reconnoitering and carried an observer; later models had a machine-gun mounted for protection mainly.

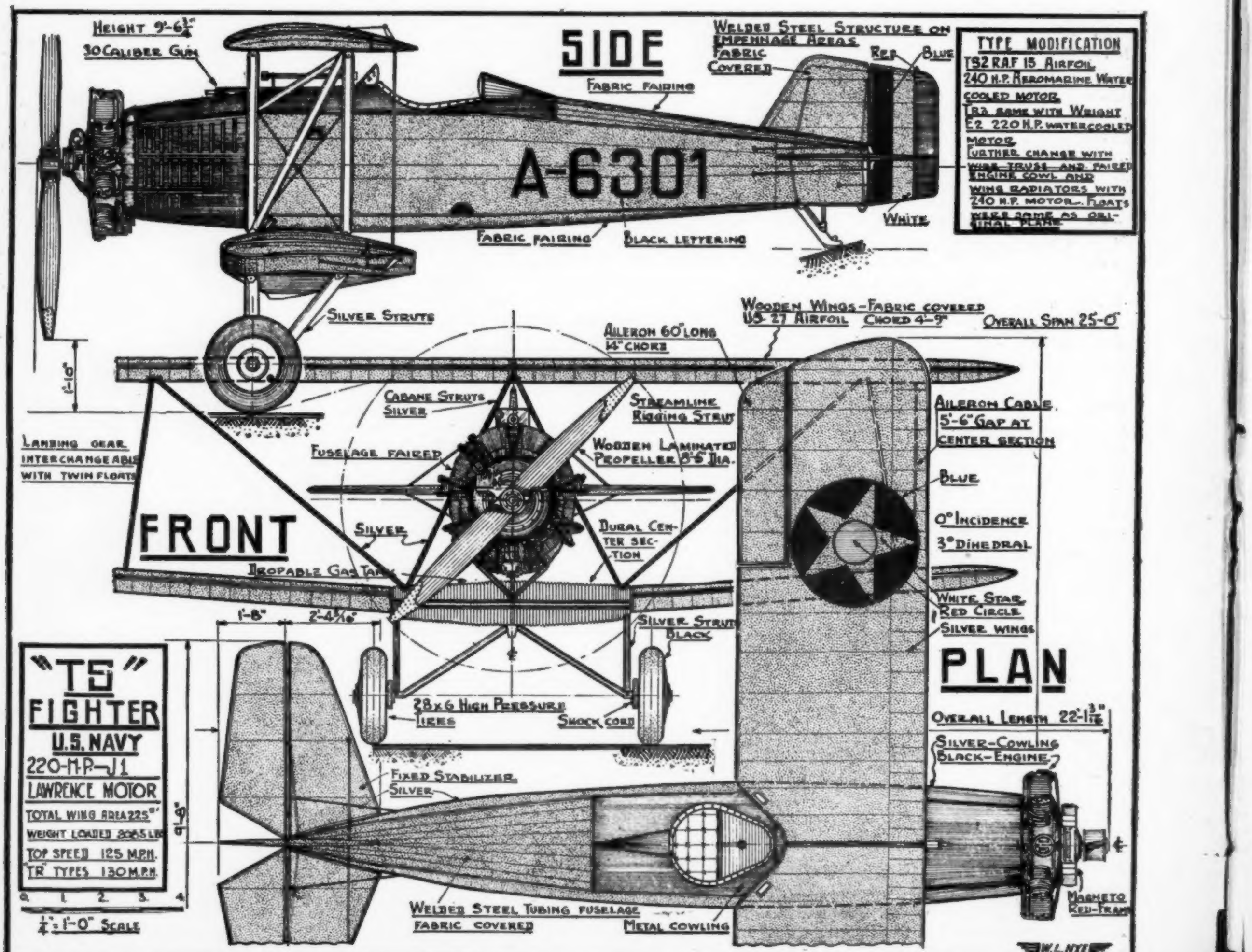
Breguet for a while lagged behind but later brought out a new group of scout and observation machines in which was featured the liberal use of aluminum such as his earlier model had incorporated.

Bleriot developed a biplane for scouting purposes, but this most interesting model was an especially finely executed monoplane in which feature was a fuselage of monocoque construction. It was easily recognized by the characteristic Bleriot wing and landing gear.

Of these various models developed, the best perhaps was the Morane Saulnier, a parasol type monoplane with a high wing. It was equipped with a Gnome rotary motor, showing a high performance with fast climbing ability. With its high wing, visibility for the pilot was much improved, a vital necessity in actual combat.

Nieuport of course continued his fine line of ships and soon developed faster and lighter models which gave good accounts of themselves in pursuit work. At first

(Continued on page 41)



The Aerodynamic Design of the Model Plane

An Analysis of the Effect of the Position of the Line of Thrust on Longitudinal Stability

By CHARLES HAMPSON GRANT

Article No. 30 **Chapter No. 3**

IN THIS instalment of our discussion of model aerodynamics, we will try to analyze and explain a condition which is understood by very few model designers. It is one of those obscure but important points usually overlooked; namely, the effect upon longitudinal stability of the position of the line of thrust relative to the center of gravity.

It has been found that the higher the line of thrust is located relative to the center of gravity, the greater the longitudinal stability of the plane. Why is this so? In order to determine "why," let us analyze the problem geometrically.

Fig. No. 104 indicates an airplane in which the line of thrust (T-T) is below the center of gravity (G). The thrust (T) is generated by the thrust of the propeller in the direction indicated by the arrow, along line (T-T). The thrust in normal flight as in this case, is horizontal. Gravity acts downward vertically as shown by the arrow from the center of gravity (G). The lift (L) acts upward on the wing.

This is not an unusual set up of forces and perhaps some readers will recognize it as one used in many indoor models. It has been stated in past pages of these articles that an arrangement of this type produces less longitudinal stability than is claimed for it by many model builders, some of them expert. It is actually much less stable than a system in which the line of thrust is above the center of gravity (G) as indicated by the dotted line (P-P), Fig. No. 104. Many of the well-known indoor model builders have wanted to know the answer, so here it is.

Let us assume that the plane has been forced up into a stall by an air gust or by a slight error in the adjustment of the model, as shown in Fig. No. 105. Under these conditions it is imperative that the forces acting on the airplane act to right the plane and return it to normal flight position. This means that the righting moments, (counter clockwise ones), should increase and the clockwise moments decrease. The latter type are the ones generated by forces tending to turn the nose or propeller end of the plane, up and over to the right, thus increasing the stalling attitude of the ship.

Suppose we see what actually happens in this case. First we have the thrust (T) acting in the direction of the arrow. This may be divided into its components, a vertical force (V) and a horizontal force (H). You will note that when the plane was flying horizontally, there was no upward pull of the propeller such as exists when the ship is nosed upward. The lift (L) on the wing is acting vertically upward and gravity (G) is acting downward as indicated by the arrow at (G).

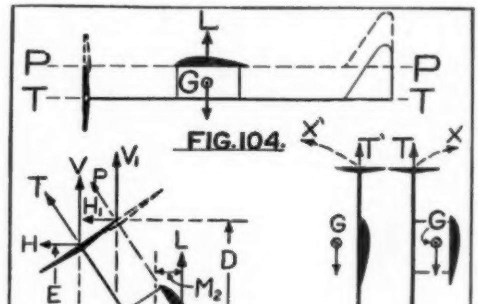


FIG. 104. FIG. 105. FIG. 106. FIG. 107. FIG. 108.

Now it can be readily seen that the propeller, generating an upward force (V) is thus tending to pull the nose of the plane upward into a more complete stall, instead of acting to right the unstable condition. The disturbing moment in this case is equal in amount to force (V) times distance (M_1), which is the distance from force (V) to a vertical line through the center of gravity (G); (G) being the point about which the plane rotates into or out of normal flight position.

The force (L) acting upward to the right of (G) forms a corrective moment about point (G), tending to lift the tail and lower the nose of the plane, and thus rotate it back into a horizontal position. The amount of this moment is equal to force (L) times distance (M_2).

We have another moment to consider, that caused by the lifting force (S) on the stabilizer. This force is created or increased in amount by the plane nosing upward and thus causing the stabilizer to pass through the air at an increased angle of attack. As it is to the right of (G), it is a righting force tending to lift the tail and lower the nose of the ship. Its righting moment is equal to force (S) times the distance from (S) to (G).

Now, as the angle of attack of the stabilizer increases to about 15° during the nosing up action, the lifting force (S) generated by it increases considerably, but beyond 15° angle of attack, the speed of the airplane and therefore the lift (S) diminishes rapidly while the disturbing moment caused by (V) increases. Also the horizontal component (H) which has a righting tendency, becomes very small with increased angles of attack.

Thus beyond a certain angle of stall, our forces change so as to cause *greater* displacement from the normal line of flight. This is an unstable condition. However, by careful adjustment of the plane, it will fly so that it will never reach the extreme stalling point at which the disturbing forces overcome the corrective ones, but such an adjustment will be made at a sacrifice of climbing angle. The whole idea is to have the plane climb at as steep an angle as possible and yet be able to recover itself.

Here we come to the crucial point. Is there any set up of forces which will create *smaller* disturbing moments, or larger corrective moments, or both? The answer is, yes!

Suppose we move the line of thrust (T-T) up to the position shown by the dotted line (P-P), Fig. No. 104, and assume that our plane has nosed upward again as shown in Fig. No. 105. The Force (V_1) is then produced by the propeller, as shown in the figure by the arrow. In this case force (V_1) is the same in value as force (V) was in the first case. However, let us look closely at the distance (M_3) from (V_1) to a line through (G). It is much smaller than in the first case, and therefore the disturbing moment (V_1M_3) is smaller than (VM_1) the disturbing moment in our first case. In other words, at the same angle of climb, the higher the line of thrust is located relative to the center of gravity, the *less* the disturbing (or unstable) moments will be.

Now let us see what happens to the righting moments when the thrust line is

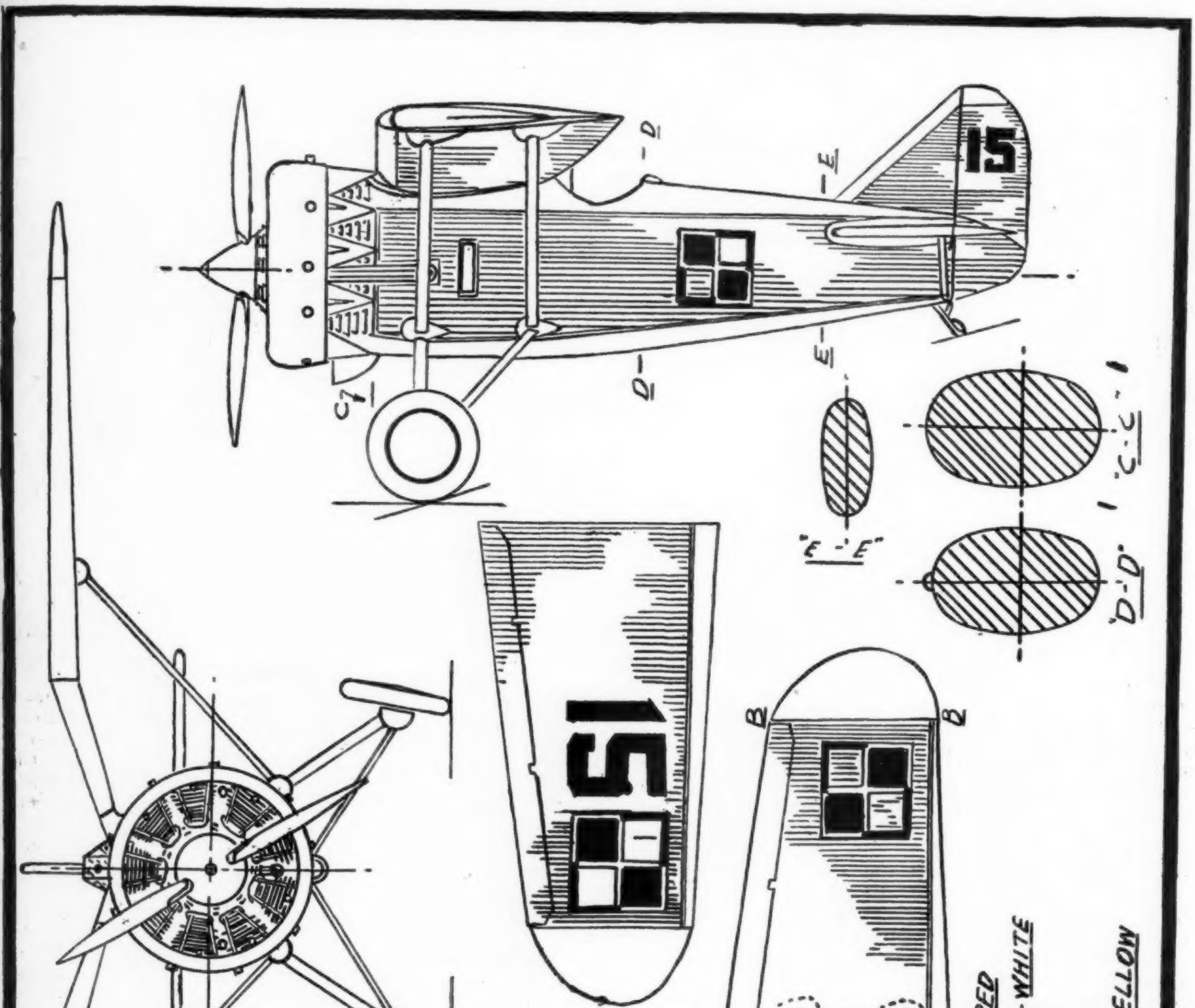
(Continued on page 40)

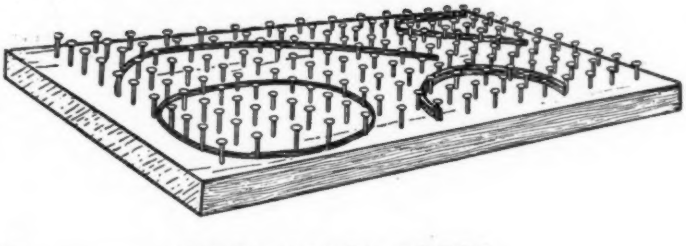
The Polish Fighter

THIS is considered to be one of the most perfect military planes in the world. It is built entirely of metal, partly smooth and partly corrugated duralumin. The color is silver with black markings. Actual performance and specifications have been kept a closely guarded secret by the Polish government.

These drawings were made from plans directly from Poland.

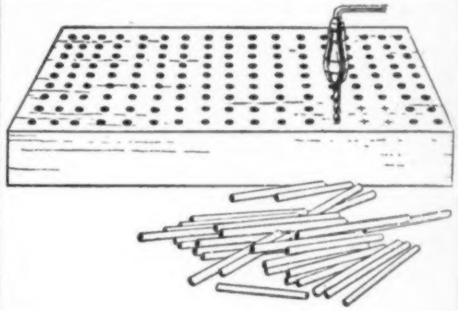
Build a solid scale model of it.





STICK BALSA PRESS

WING DIHEDRAL BLOCK



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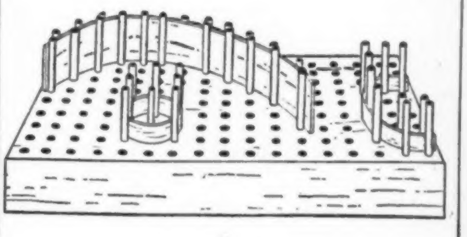


2

SHEET BALSA PRESS

Short Cuts for the Model Builder

By EDWIN T. HAMILTON

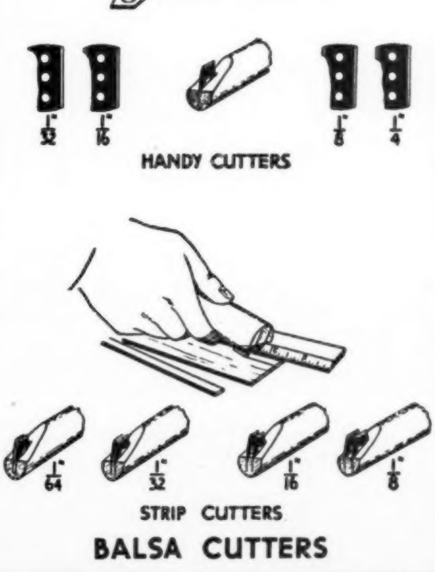
IT IS often quite difficult to make exact cuts in balsa wood when they are as small as 1/32" square or even ⅛" square. The handy cutters shown in the illustration eliminate all such difficulty. They can be made as required, or the builder can make a set of such cutters, so that they will always be on hand when needed.

Obtain a number of old double-edge safety razor blades. Break one edge until only a portion of the cutting part remains. A 6" length of 1" or 1½" dowel stick is then half-beveled at one end and a knife slot cut in it. Cement the blade in this slot so that only the end having the cutting portion of the blade extends from it.

For all general work, a 1/32", 1/16", ⅛" and ¼" cutter will be all that is required. Old broom handles can be substituted for dowel sticks if these are difficult to obtain. Mark each cutter's handle with the size of its blade, so that each can be quickly recognized.

As we all know, it is considerably cheaper to purchase balsa in large pieces and then cut it to size, than to order the various required strips. When the supply houses cut these, they must charge a fee for the work, but this cost can be eliminated by cutting our own strips. The handy strip cutters, shown in the illustration, make this work quite simple. In handles prepared the same way as those of the hole cutters, two razor blades are cemented. Break these blades until about ¼" of their cutting edges remain. Insert them in slots cut at various distances apart, and cement solidly in place. Four of the most useful of these are shown. To cut a strip of balsa 1/64" wide, set the blades of the cutter 1/64" apart until a different size is required.

The cutting is always done with the grain of the wood, and against a straight edge, such as a ruler.



BALSA CUTTERS

Dihedral Block

Here is a simple block that is guaranteed to save you considerable time and effort when assembling wings with a dihedral. Obtain a block of any wood 6"x6" and 7" long. Cut it along the diagonal, as shown. With a steel point, measure up its side ½", 1", 1½", 2", 2½", 3", 3½", 4", 4½", 5", 5½" and 6" high. Mark each of these measurements across the diagonal cut, as shown, which completes the block.

To use the block, place one half of the wing flat on a table and bring the tip of the other half along the block until it touches the line indicating twice the desired wing dihedral. The two halves are then cemented together and the raised half left on the block until dry. For example, if the wing calls for a 3" dihedral, the raised side must have its tip resting on the line marked 6". When cemented, both tips will have a 3" dihedral.

Stick Balsa Press

This press saves time when bending balsa strips to any desired form. After the balsa has been soaked and properly bent, it requires a lot of handling to hold it in form until dry. The press shown here will do this for you.

On a flat piece of any hard wood, drive rows of nails, as shown. Allow them to extend up from the surface about ½". Box nails having large heads are best, as the heads will prevent any possibility of the wood slipping off the nails. When the desired bend has been completed, place the

(Continued on page 47)

Ruggeri with his record breaking twin pusher
Courtesy of Phil Leibowitz

Build This World Record Twin Pusher

Here Are Plans and Instructions From Which You Can Build a Plane That Holds a World's Record. It Has Placed Among the Winners Every Time It Has Been Flown

By AUGUST RUGGERI

WHO does not become thrilled when he see his model plane rise skyward for several minutes, possibly disappearing into some fluffy cloud?

Flights of this sort are easily made by the twin pusher type of model airplane, especially by one that generally proves to be a consistent flyer. The twin pusher, for which plans are given in the following pages, has proved to be worthy of the name "consistent flyer" given to it by John Zaic.

This twin pusher won second prize in the contest held at the Valley Stream Airport, L. I., on June 25th, 1933, with a flight of 3 min., 53 sec. At that time, the model was not properly adjusted, but with slight changes in design and some readjustments, the model was ready for the national contest held at Roosevelt Field on June 27th, 1933.

The morning of the day on which the contest was held, was a little discouraging. As some of the model airplane builders who were present will remember, a little rain fell in the early morning, but before we had a chance to become entirely disappointed, the sky began clearing. Most boys know that upcurrents are usually found over sandy areas right after a rain, provided that our friend, the sun, comes out in full strength. The reason for this is that the surface of such sandy ground becomes heated and dries faster than other parts of the terrain upon which vegetation is in growth. For that reason, the afternoon was not bad for flying models.

At about two o'clock in the afternoon, I decided to give my model a flight. I called my friend, Peter Bolker, who had volunteered to give his assistance, and soon we had the model wound to its maximum capacity. After the release of the model, the two powerful rubber motors combined with the two efficient low-pitched propellers, gave it an astonishing rate of climb.

The pusher starts for a record

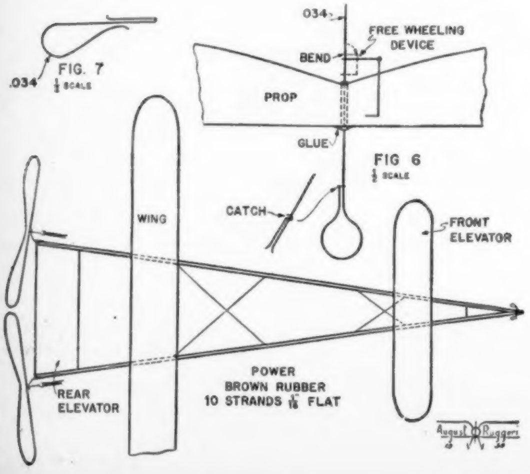
In two minutes the model was well up in the air "hanging on the clouds." During the rest of the flight, it glided gracefully, until finally the ground was reached. The official time, as recorded by the judges, was 7 min., 36 sec., breaking the previous record of 6 min., 57 sec. This flight won second prize in the Mulvihill event, the first prize going to Bassett who flew a model equipped with a gasoline engine. Two weeks later, first prize was won by this record-breaker in the twin pusher event of the New York City Air Derby, held in Central Park on July 15th. The official duration of the flight made then was 6 min., 12 sec., after which the model disappeared above the tall buildings. However, the actual time in the air was much longer.

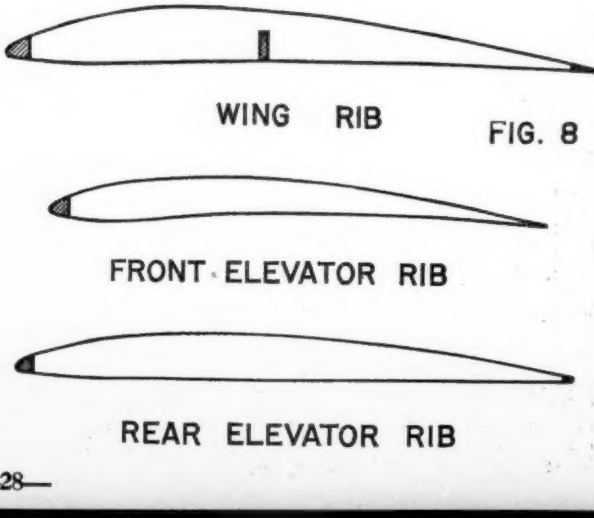
I suppose that by this time everyone is anxious to know how to build this model that made such outstanding flights. Probably the best way to build it is to start on the construction of the fuselage. The longerons used for the V frame of the fuselage are made of two 1/8x3/8x40 hard balsa strips. They should be sanded until a cross section is obtained as that shown in fig. 1, after which a coat of dope is applied. After resanding with #10/0 sandpaper, so as to get a very smooth finish, they are joined at one end as is shown in fig. 2. A strip of bamboo is placed at the other end of the frame in order to keep the longerons 11 inches apart there.

The next step is to put the cross bracings in their right places, spaced as shown in fig. 1. They are made of 1/16 x 1/16 bamboo and are joined to the fuselage by putting them through the longerons as is shown in fig. 11.

We are now ready for constructing the rear elevator which is built on the fuselage. Cut nine rear elevator ribs out of very soft balsa to the shape shown in fig.

(Continued on page 48)





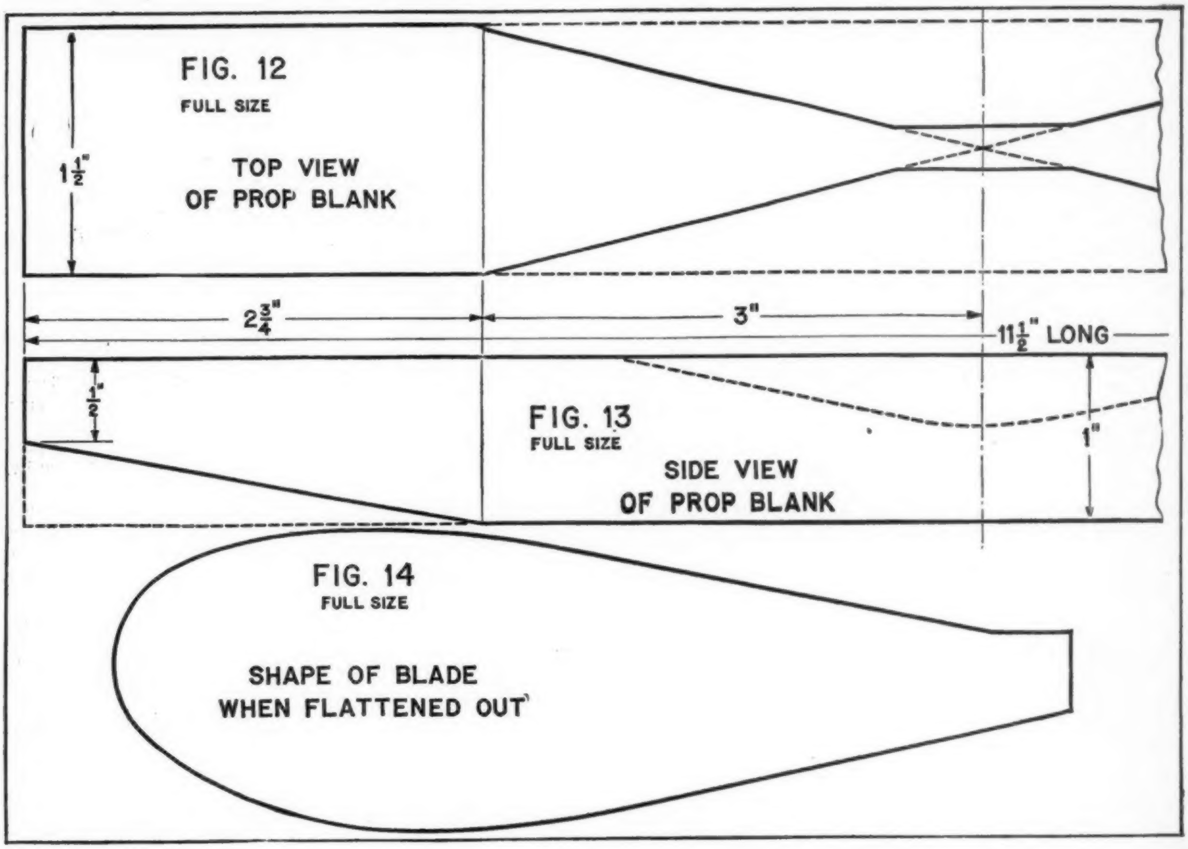
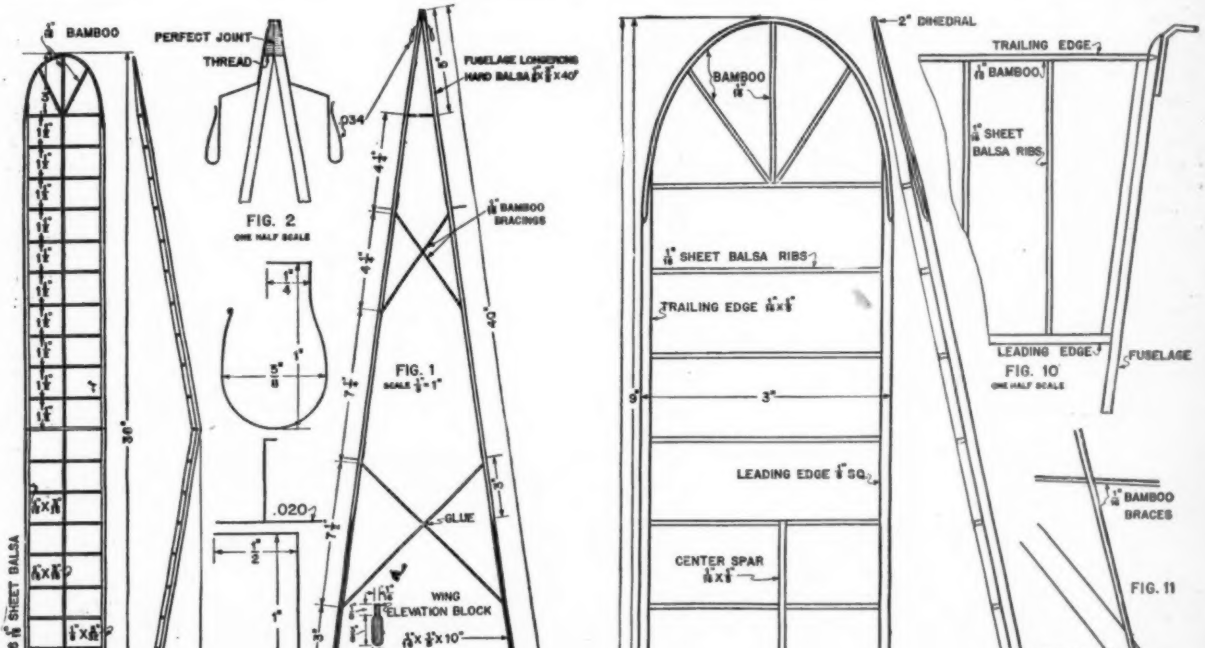


FIG. 12
FULL SIZE
TOP VIEW
OF PROP BLANK
$1\frac{1}{2}$"
$2\frac{3}{4}$"
3"
$11\frac{1}{2}$" LONG
FIG. 13
FULL SIZE
SIDE VIEW
OF PROP BLANK
$\frac{1}{2}$"
1"
FIG. 14
FULL SIZE
SHAPE OF BLADE
WHEN FLATTENED OUT


BAMBOO
PERFECT JOINT
THREAD
.034
FIG. 2
ONE HALF SCALE
FUSELAGE LONGERONS
BAMBOO BRACINGS
FIG. 1
GLUE
WING
ELEVATION BLOCK
.020 WIRE
.020
11"
SQUARE
TAPERED TO
RIBS SHEET BALSA
30"
3"
FIG. 3
FIG. 4
FULL SIZE
BAMBOO
SHEET BALSA RIBS
TRAILING EDGE
3"
9"
LEADING EDGE SQ.
CENTER SPAR
CENTER RIB
16"
2" DIHEDRAL
FIG. 9
ONE HALF SCALE
TRAILING EDGE
BAMBOO
SHEET
BALSA RIBS
LEADING EDGE
FIG. 10
ONE HALF SCALE
FUSELAGE
BAMBOO
BRACES
FIG. 11
FUSELAGE
INCIDENCE BLOCK
SQ.

THE NATIONAL AERONAUTIC ASSOCIATION JUNIOR MEMBERSHIP NEWS

Chapter News

THIS month has brought into the N.A.A. several new chapters of junior members. Stix, Baer and Fuller Junior Chapter of Saint Louis, Missouri, has nearly one hundred charter members. This club is sponsored by the Stix, Baer and Fuller Company and has been an active model airplane club for many years. Members of the club have always made good at the various national meets. The total membership of the club numbers several hundred but one of the club's requirements is that a member must attain a high degree of excellence before being allowed to enter the ranks of the junior N.A.A. group.

Mr. Claude Carmichael is Club Director and Mr. H. T. Sommers is Club Instructor and Contest Director. Much will be heard from this new chapter in the months to come. Many high caliber meets are held annually for club members.

INDIANAPOLIS has a junior chapter under the direction of Mr. Herschel S. Knight. Many of the members are well known nationally, most famous being Vernon Boehle who has been prominent at the last two National Championship Meets. It is certain that this club will maintain a very high standard of competitive activities. Club Secretary is Jim Cahill of 1419 N. Gale Street, Indianapolis, Indiana. He will be pleased to answer the questions of all who are interested.

MADISON, Wisconsin, claims two junior chapters due to the efforts of Mr. Carl Goldberg. Last year was Carl's last as a junior member of the N.A.A. and now that he has graduated into the open age class, he has decided to take up club direction in a big way. With a club leader of such experience, it should be only a short time before the two Madison N.A.A. junior chapters have established themselves in the record lists. Full information may be obtained from Mr. Goldberg at 138 Lathrop Street, Madison, Wisconsin.

FRESNO Chapter, Junior Division, of Fresno, California, continues its life of club activity by suggesting an Honor League for Model Aircraft Builders. The requirements for membership in the league would be based on performance in model building and flying which would stamp all members as distinctly above the average. Anyone interested in assisting this suggestion to become a reality should communicate with the club's president, Virgil Weidner, Fresno Chapter, N.A.A., Hotel Fresno, Fresno, California.

AKRON Chapter remains the most active in point of enrolling new junior members. This is no doubt due to the interest brought about by the 1934 National Championship Meet being held in Akron. Every week brings an additional list of new Akron junior members.

American Legion Annual Model Plane Met

THE American Legion announces its 1934 annual meet to be held in Indianapolis August 25 and 26. This meet is to be national and is open to all. Last year the Legion held a very successful meet somewhat later in the summer than the dates of this year's meet and the interest shown then has caused the Legion to decide to make the meet an annual affair.

There will be indoor and outdoor events with a good list of awards. Full information may be obtained from Major Weir Cook, Director of the Aeronautics Commission, American Legion, 777 North Meridian Street, Indianapolis, Indiana.

It is earnestly recommended that as many N.A.A. junior members as possible attend the Legion Meet. The rules are patterned after the N.A.A. competition rules and several novelty events are a part of the program.

The Legion is urging its various Districts and Departments to conduct preliminary contests with the thought in mind of sending these winners on to Indianapolis.

RECENT MODEL PLANE MEETS

The Eastern States Outdoor Meet

THE Eastern States Outdoor Meet was held at Newark Airport, May 19. The attendance, both contestants and spectators, was excellent. Weather conditions were better than average. The outstanding performance was by Bruno D'Angelo of Philadelphia when he flew his outdoor stick model to a new record of 8 minutes 29 2/5 seconds.

There were five gasoline models in this meet and several excellent flights were recorded. The winner of the gasoline model event was National Champion, Maxwell Bassett of Philadelphia. Bassett's flight time was less than his record due to the limited amount of fuel which the rules permitted him to use.

There were three events on the program and all three were won by members of the Northeast Chapter, N.A.A., Philadelphia. The Philadelphia boys are setting a high standard of competition and now have a large percentage of the official records

This meet was under the joint sponsorship of UNIVERSAL MODEL AIRPLANE NEWS and the Bamberger Aero Club, N. A. A. Junior Chapter of Newark. Mr. Irwin S. Polk and Mr. Charles H. Grant shared honors as Contest Directors.

Salinas California Tri-County Model Plane Meet

A MOST exciting model airplane meet was held in Salinas, California, on Saturday, May 5, being sponsored by the Salinas city schools and the Index-Journal. Participants came from three counties, Monterey, Santa Cruz and San Benito. There were approximately one hundred entrants with a dozen girls among them.

A Chinese boy, Hing Lee, was chief winner. Although the flight times were not remarkable, enough class was shown to indicate that the California boys are a real threat in the record setting picture.

One of the features was a prize for the worst crack-up. What a time the judges must have had in determining this winner! Usually there are so many swell crack-ups that this particular event must have had the most contenders.

The Contest Director was Mr. S. P. Reed of the Salinas Central Grammar School who has been an officially appointed N. A. A. Contest Director for Model Aircraft several months.

Prizes were radio sets, theatre passes, wrist watches, airplane rides, sport sweaters, construction kits and other items of value. The airplane rides were provided by Mr. William Swain, manager of Salinas Airport.

After the official flying events, a special model stunt plane devised by Mr. A. T. Krusic, San Francisco N. A. A. Contest Director, gyrated into snap rolls, power dives, flat spins and wing-overs, executing each as if a pilot sat at the controls.

The winners: Stick Model, hand-launched, Hing Lee; Fuselage Model, R. O. G., Hing Lee; Flying Scale Model, John Anderson; Exhibition Scale Model, Norman Rhodes; Solid Scale Model, Charles Patterson. John Anderson also was the winner of the special prize for the worst crack-up.

New England Championship Model Flying Meet

THE most successful of New England meets was held in Boston May 26 and 27. Much of the success of the meet is due to the untiring efforts of the sponsors, the Junior Aviation League. Jordan Marsh Company and the Boston Traveller make it possible for the League to carry on as the Boston Junior Chapter of the N.A.A.

Leslie Adams, Peru, Indiana, with his Wakefield model

Captain Willis C. Brown, Club Adviser, acted as Contest Director and did a remarkably fine job. Capt. Brown is a member of the Army Signal Corps and installed some unique radio equipment to keep the timers, officials and scoreboard informed of the meet's progress. A loud speaker public address system kept the spectators informed right up to the minute of all that happened.

The indoor events and winners: Hand-launched gliders: Hewitt Phillips, 21 3/5 seconds; Stick Model R.O.G.: Wilbur Tyler, 7 minutes, 41 2/5 seconds; Fuselage Model R.O.G.: Hewitt Phillips, 5 minutes 12 3/5 seconds; Stick Model, Hand-launched: Wilbur Tyler, 10 minutes 24 seconds. The outdoor events and winners: Fuselage Model R.O.G.: Theo. Petersen, 3 minutes 17 seconds; Stick Model, Hand-launched: Barbara Maschin and Louis Marcucelli tied for first at 4 minutes 03 seconds.

Barbara Maschin was the only girl in the meet. She has been competing in eastern meets for the past half year and is making quite a name for herself. Barbara is from Westfield, Mass. and is a member of the Junior Aviation League of Boston as well as a member of the Springfield Model Airplane Club. Both of these clubs are N.A.A. junior chapters.

The New England Championship Model Flying Meet was attended by more than five thousand spectators. It is evident that interest in model airplanes is keen around Boston. The Junior Aviation League is deserving of much praise for their fine club and record of achievement.

Wakefield International Competition

THE Wakefield International Competition was held in England on Sunday, June 24. Results of the competition were not at hand when this went to press. The United States had a full membership of six on its team and hopes are running high that one of these will prove to be the winner. Photographs of three of the American entrants with their models are shown on this page.

Several of the American models were powered with multiple rubber motors by means of gear drives. There is a real need for a satisfactory method of multiple

Walter Getsla launching his "BROCK III" model

motor gear drive and it may be that this year's Wakefield Competition will give the model game this improvement.

Remarkable Gas Motor Model Flight

TWO hours thirty-five minutes in the air and a flight from Central Airport, Camden, New Jersey, to Armstrong's Corner, Delaware, is the new unofficial record established by Maxwell Bassett with his gasoline powered model plane. The flight was made on May 28 by Bassett's "MISS PHILADELPHIA IV" with a tankful of fuel. Timers were Mr. Victor R. Fritz and Captain Jack Byrne who followed the model in a Fairchild plane.

The model made a straight line flight of fifty-four miles but the total distance that it traveled was estimated as one hundred and eighty miles. At its greatest height the model reached an altitude of eight thousand feet. It crossed the Delaware River three times in its flight.

This record cannot be accepted by the Contest Committee as an official record because the present rules for gasoline powered models limit the amount of fuel that may be carried. However, the flight was timed by N.A.A. officials and is worthy of being considered the unofficial world record for models of its class. Bassett is to be congratulated for his excellent flight.

New Official Model Plane Records

THE following model plane records have been accepted by the Contest Committee as new official records:

Indoors

STICK MODEL AIRPLANE, R.O.G., Class B.

Junior: James Mooney, Philadelphia, 8 minutes 56 seconds.

Senior: Norman Schaller, Philadelphia, 9 minutes 34 seconds.

STICK MODEL AIRPLANE, Hand-launched, Class B.

Senior: George Waite, Philadelphia, 9 minutes 39 seconds.

STICK MODEL AIRPLANE, R.O.W., Class B.

Senior: Mayhew Webster, Philadelphia, 8 minutes 05 4/5 seconds.

Alton H. DuFlon, Jr., with his "MISS RIDGEFIELD"

FUSELAGE MODEL AIRPLANE, R.O.G., Class B.

Junior: Hewitt Phillips, Belmont, Mass., 5 minutes 12 3/5 seconds.

Senior: Bert Bradshaw, Colwyn, Pa., 7 minutes 15 seconds.

FUSELAGE MODEL AIRPLANE, R.O.W., Class B.

Junior: John Stokes, Huntingdon Valley, Pa., 3 minutes 23 seconds.

Senior: William Latour, Philadelphia, 2 minutes 43 3/5 seconds.

GLIDER, Hand-launched, Class A.

Junior: Hewitt Phillips, Belmont, Mass., 21 3/5 seconds.

AUTOGIRO.

Senior: Herbert Greenberg, Newark, N. J., 1 minute 38 seconds.

Outdoors

STICK MODEL AIRPLANE, Hand-launched, Class C.

Senior: Bruno D'Angelo, Philadelphia, 8 minutes 29 2/5 seconds.

FUSELAGE MODEL AIRPLANE, R.O.G., Class C.

Senior: Theo Peterson, Everett, Mass., 3 minutes 17 seconds.

There are a number of other new records that have not been given the necessary final check to warrant their submission to the Contest Committee but which are expected to be of sufficient merit to be given consideration later. These records, together with those from the 1934 National Championship Model Airplane Meet, should make quite a change in the existing records and will be published in the next issue of this magazine.

THE National Aeronautic Association offers you model builders and flyers membership in a national aviation organization that insures recognition of record making flights, quarterly bulletins that will keep you up to date in the latest refinements of the art, together with the realization that you are working right along with the leaders in national aviation. The Association aims to keep "America First in the Air." Those under twenty-one are entitled to membership as junior members at twenty-five cents a year with an additional initiation fee of twenty-five cents. Those over twenty-one may become regular members at five dollars a year. A special model flying permit is offered to non-members who are over twenty-one at one dollar a year.

Only N. A. A. members or those with special permits are eligible to compete for N. A. A. trophies and awards, or to have their flights given official recognition for record purposes. As the representative in the United States of the Federation Aeronautique Internationale, the Association has as a special responsibility the encouragement and regulation of air meets, races, and record trials.

Eliminating "Beats" From Motors

UP to the present airline pilots have had to "tune" the motors on the big airplanes by ear in order to eliminate the "beats" which occur if there is a difference of even ten revolutions per minute in the speed of the different propellers. Previous tests have shown that, unless a pilot possessed a good "ear for music" he could not properly synchronize his engines. The task was further complicated by the other various vibration "beats" in the airplane and aeronautical engineers, for years, have been searching for a positive and mechanical, means for synchronizing engines. Pilot Kraigher, who carried on a series of independent studies of this problem, was standing on the ground to watch the engines on a tri-motor being "tuned" when he discovered that by looking through one of the outboard propellers to the propeller of the center engine, a definite, unvarying line was visible when both propellers were turning at the same speed. When one propeller turned faster than the other, the line would move upward and when slower, would travel in the opposite direction.

The phenomenon was found to be caused by the whirling blades of the propeller nearest the eye acting as the shutter of a motion picture camera or "stroboscope." By its shutter-like action it allows the eye to see a portion of the propeller which is farthest from the eye. Thus, if the two propellers are moving at the same speed, the visible portion of the second propeller is seen at exactly the same location on each revolution. If there is a difference in speed between the two, the visible portion will appear in a constantly changing location. When both propellers are moving at exactly the same speed the visible portion of the second propeller seems to stand still, making one straight line.

The only remaining problem was to bring these lines within the range of pilot's vision from the cockpit. This was accomplished by mounting a convex mirror to the cowling of each outboard motor so that the pilot could look through the outboard propellers to the center blade. All Pan American tri-motors are now equipped with this device and through the entire test period it has proved to be a positive means of measuring the revolutions of the three propellers with absolute accuracy, as well as providing considerable supplementary data on the study of propeller reaction to various motor speeds.

"As the Crow Flies" Not Good Enough

THE operation of an airline between two cities "as the crow flies" would be an inefficient and time wasting business, according to pilots who have studied the flying habits of these birds.

Contrary to popular opinion, the crow is an erratic flyer, maintaining neither the same altitude nor the same direction for more than a minute or two, the pilots say. "As the duck flies" would be much more appropriate, they say, because the water fowl fly in precision formations, as straight as if guided by a compass.

But, even the ducks with their nature-given instinct for direction can't compete in their navigation with the instruments which pilots now use in flying modern transport planes.

Thus, the modern metaphor for a straight line between two points might be stated "as the airplane flies", for nothing in nature maintains a course through the air with anything approaching the precision of today's transport planes.

NATIONAL AERONAUTIC ASSOCIATION OF U. S. A.
DUPONT CIRCLE
WASHINGTON, D. C.

I hereby make application for membership in the National Aeronautic Association as a Junior Member. I am under twenty-one years of age.

I enclose fifty cents for initiation fee and first annual dues (Use check or money order.)

Name ....
(Please print or type)

Street ....

City .... State..................

Date of Birth ....
(Month, Day, Year)

Approved ....
(Parent sign here, if applicant is under eighteen)

Insignia of the U. S. Army Air Corp

1st Observation Squadron
A brown caveman wearing a black breech clout, standing on a black mound, looking to dexter with right hand shielding his eyes, left hand holding a spear horizontally in front of a rising sun against a blue background; all within a green bordered gold annulet bearing thirteen black crosses.

94th Pursuit Squadron
American Indian Head, face brown with black, blue and red markings. War bonnet white feathers tipped with blue, yellow and blue head bands, ribbons red and blue.

16th Observation Squadron
Binoculars, white with black shading.

95th Pursuit Squadron
Mule, brown on light blue circular background.

22nd Observation Squadron
Blue disc, white stars, red to yellow tail.

9th Bombardment Squadron
Black disc, within an orle of silver another disc gray and black, Roman numeral IX in silver.

26th Attack Squadron
Shield, upper half orange; lower half blue. Clinched fist, upper half blue; lower half, orange.

8th Attack Squadron
Eagle proper, white head. Bell, blue. Center circle white. Middle circle, green. Outer circle, yellow.

24th Pursuit Squadron
Tiger in proper colors.

44th Observation Squadron
Indian in blue silhouette on yellow disc piped with red.

27th Pursuit Squadron
Falcon proper on a red disc.

2d Observation Squadron
A white disc within a black circle, rising out of green sea. In the lower part of the disc Neptune riding a seahorse and holding in his hand a trident in black silhouette.

19th Pursuit Squadron
Cock, black and white, red comb, on yellow disc; black border; 19 rosettes consisting of six pointed star and six dots all white.

3d Pursuit Squadron
On a blue triangle piped in black point down a fanciful creature with the head of a parrot, the winged trunk of a lion and the tail of a sea serpent. Black head and trunk, red and white eye, orange bill, red tongue, white wing and orange tail.

55th Pursuit Squadron
Yellow disc bordered in blue, blue annulet, arrow and sword black, portion on border yellow. Wings proper.

99th Observation Squadron
Buffalo, red lined with blue.

34th Pursuit Squadron
Black futuristic bird, red eyes, red and white striped breast, red lightning on white circular background piped in black.

73d Pursuit Squadron
Golden bear with black shading, red eyes and tongue, on blue circular background piped in yellow.

11th Bombardment Squadron
Jiggs, black suit and hat, red vest, blue tie, white spats, light blue bomb, trimmed in orange, on circular white background with black piping.

91st Observation Squadron
Gray armor, green shield, black cross piped with white, yellow plume, brown spear, black horse, harness yellow, red devil, yellow background, brown fork, superimposed on diamond upper half, blue; lower half, green.

30th Bombardment Squadron
"Sergeant Branner," blue with blac and yellow trimmings, and shoes i black border. Compass points gree

28th Bombardment Squadron
Indian Head, brown yellow he band, yellow ribbon on hair, yell beads. Black hair, ears and whiske white eye with black pupil, fa markings red piped with yellow, r mouth, blue feather tipped with re blue diamond.

35th Pursuit Squadron
Silver oval within a blue border, a black panther, tongue red.

72d Bombardment Squadron
White clouds and lightning on circular background of black.

20th Bombardment Squadron
Pirate with tanned face, tan arms, black mustache, red cap with white stripes, yellow jacket, black cape and comb; pants, shoes and stockings, brown. Alternate green and white

(Continued on page 48)

Aviation Advisory Board

Conducted by
CHARLES HAMPSON GRANT
Chairman of the Board
Formerly of
The Technical Section, Air Service, U. S. Army

THE model builders are at it again, getting ready for the summer contests which are being held in various parts of the country. It is not necessary that they tell us this directly, for we know that it is so by the number and kind of questions we receive in our Advisory Board Department.

We have a number of questions of common interest from boys all over the country to answer in this issue.

Mr. A. Kaufman of 4654 St. Louis Avenue, Chicago, Illinois, wants to increase his stock of information by having us answer the following questions:

Question: Which is more efficient, a biplane or a monoplane?

Answer: The comparative efficiency of both depends upon what one means by the word, "efficient." Speaking from a purely aerodynamic standpoint without considering the structure of the machine, a monoplane is about 25% more efficient. However, if we are to take the two machines, a monoplane and a biplane, and compare the efficiency of each to the amount of load which can be carried regardless of wing area, we may say correctly that they both approximately have the same efficiency. The reason is this: though a biplane is inefficient aerodynamically, the type of structure encountered in the biplane makes it possible to reduce the total weight of the machine about 25% and yet have the same wing area as the monoplane. Thus the decrease in weight offsets the added aerodynamic efficiency of the monoplane.

Question: Which is more stable, a monoplane or a biplane?

Answer: The stability of either type of machine depends entirely upon the design of the ship. Either a monoplane or a biplane can be unstable as each type of ship is a separate problem in design. However, there are more ways or means which can be taken to make a biplane stable than can be taken in the case of the monoplane.

Question: Which is stronger, the monoplane or biplane?

Answer: The strength of each depends upon how each is designed. Either one could be weak or either one strong. However, as a rule, biplane construction lends itself to greater strength. A biplane may be built lighter than a monoplane with the same strength.

Question: In a biplane, if dihedral and sweepback are used, is it advisable to build the dihedral and sweepback into the same wing or in both wings?

Answer: The best results can be obtained if the dihedral is used in the top wing and the sweepback is used in the lower wing, especially if the tips of the lower wing are given a slightly smaller angle of incidence than the center portion. This arrangement will make an airplane very stable. If the same amount of dihedral or sweepback is given to both wings of a biplane, the ship will have a greater tendency to rock or execute unstable movements than in the case where the wings are of unequal dihedral or unequal sweepback.

Question: What are the advantages and disadvantages of positive and negative stagger? Which is the best to use?

Answer: Positive stagger increases the aerodynamic efficiency of the biplane combination; the greater the stagger the less the "interference" between the two wings. This gives a smoother air flow. There is no aerodynamic disadvantage to a positive stagger. Structurally a positive stagger combination cannot be made as strong as a normal box biplane. There is no aerodynamic advantage to a negative stagger. A negative stagger, in fact, decreases the efficiency of the biplane combination. It is sometimes used in order to give visibility to pilot and gunner.

Now we come to some questions from Alvin J. Brault of 103 East Cook Street, New London, Wisconsin. He is worried about the stalling tendency of Frank Hawks' new "Sky Chief."

Question: How do the wing flaps of Frank Hawks' plane operate to reduce the landing speed without stalling the ship?

Answer: The ship does not stall because the lift is increased at any particular angle of attack of the wing, by the flaps. In other words, though the flaps slow the ship down by affording added resistance, the ship is able to fly at this slower speed, not at the stalling angle, because the lift is also increased by the flaps. The angle of attack of the wing is controlled by the pilot using the elevators, as in a normal ship. The wing is held by the control of the flippers at an angle below the stalling point. It is obvious that the ship will not stall unless the wing angle of attack is increased to the stalling point. This obviously can be controlled by the pilot, as described; just as a ship can be controlled by a pilot without a flap.

For any given wing section there is a fixed relation between the top speed and the landing speed. However, by using a flap, this fixed relation is changed because the airfoil section is changed when landing. A plane equipped with flaps glides at a steeper angle, it is true. This is due to the fact that the lift is only five or six times the resistance of the wings when the flaps are down. The lift is increased, but the resistance is increased much more in proportion than the lift. Readers familiar with aerodynamics wil know that the glide angle is always proportional to the L/D or lift to drag ratio of the airplane.

Well, we hope this rather technical explanation has not scared off some of our readers. Here is a question that may be of interest and which is not so technical.

Mr. John F. Roche writes us from 3027 Agnes Avenue, Kansas City, Missouri, and says that he is interested in

Major Alexander De Seversky's latest production, the SEV-3L, pursuit ship. It is said that it has a speed of 225 m.p.h.

building a small wind tunnel for testing models and parts up to twenty-four inches in size. He wants to know if we can give him any information concerning the building of one.

Answer: Such an explanation given in terms which would be of practical value would obviously be too long for these columns. However, we are appealing to readers of our magazine who may possibly have some information concerning small wind tunnels or some plans from which one may be built, to come to the rescue of Mr. Roche by getting in touch with him about the matter. We refer Mr. Roche to the first article in this issue of UNIVERSAL MODEL AIRPLANE NEWS for general information about wind tunnels, by Professor Klemin. He may possibly find something of great value there.

Mr. Kendal Robinson of Salt Point Road, Poughkeepsie, New York, asks:

Question: Is there any difference between angle of attack and angle of incidence?

Answer: There most certainly is a difference and we advise that our readers who do not know the answer, study the answer given here. The angle of attack is the angle at which the chord of the wing of an airplane meets the air stream flowing against it. In level flight where the fuselage is horizontal, the wings meet the air stream at a very small angle, approximately zero to three degrees. When the aviator wishes to climb and depresses the tail of the airplane, the wings meet the air at an increased angle of attack. This is necessary in order that the ship climb.

However, during all these maneuvers the angle of incidence has remained constant, for this angle is one which is built into the ship itself and it does not vary unless the wing drops off or is twisted. It is the angle that the chord of the wing makes with the line of thrust, the "line of thrust" being the line passing through the center of the propeller shaft and parallel to it. In modern planes this angle is usually zero to three degrees. In other words, when the airplane is flying level, the line of thrust is horizontal and the angle of incidence under these conditions, is equal to the angle of attack.

Question: Are there any restrictions against flying a home-made glider in New York State?

Answer: Yes, there are some restrictions. A home-made glider cannot be flown at any airport or on public property unless it is licensed. However, it may be flown on your own property or over private property with permission of the owners.

Here are some questions from Cebert Walter, Mooreland, Indiana, R. R. 1.

Question: Would a three-bladed propeller be more efficient than a two-bladed one on a fuselage model?

Answer: In itself a three-bladed propeller is not as efficient as a two-bladed one. On a fuselage model it would not be as efficient as a two bladed one. However, it might be advantageous to use a three-bladed propeller when the required blade area is so large that it is necessary to use a propeller whose diameter is more than

one-half the wing span. In this case if a two-bladed propeller were used, the torque of the large diameter propeller would have a tendency to make a model unstable. In other words, whenever a builder finds that a two-bladed propeller of correct design is too large for his model, he should use a three-bladed one, thereby obtaining the required amount of blade area without excessive propeller diameter. This is often done in cases where a model builder wishes to use a shorter landing gear than would be possible with a two-bladed propeller of large diameter.

Question: What are the different types of wing sections, also which give the most lift and speed?

Answer: Obviously, it is impossible here to list all of the different types of wing sections for they would take up the whole magazine. However, if Mr. Walter will look on pages eleven, twelve and twenty-eight of the March, 1932, issue, he will see some diagrams of various types of wing sections with accompanying explanations.

Usually a wing section which is thick, having a high camber on the upper surface and a flat under surface, or an under surface with a high camber, is what is known as a high lift section. It gives great lift at a proportionally slow speed.

A speed section is one which is usually very thin; that is, the height of the camber at the widest point of the airfoil section is small proportionately to the chord. Speed sections usually have a camber height of one-sixteenth to one-twelfth the length of the chord. There are some sections known as "M sections." In these sections the lower surface is bellied or cambered downward instead of upward. They look like slightly bent streamlined sections. In such wing sections, the movement of the center of pressure is greatly reduced because of the character of the lower surface.

Question: Why do real airplanes use propellers so much smaller according to their size than models do?

Answer: This question is answered in the Advisory Board of the June 1934 issue in the last paragraph of the center column, page thirty. Briefly, it is because the pitch speed of a model must be greater in proportion to its size than that of a large ship; "pitch speed" being the number of revolutions per minute of the propeller, times the pitch of the propeller. If a model's propeller were the same size in proportion to a large ship, it would have to spin excessively fast in order to travel at the proper pitch speed. The speed of the propeller may be reduced if it is made larger, because it then travels farther in one revolution, and to cover a certain distance fewer revolutions per minute are necessary.

Well, the lights are getting low and the janitor is locking the doors, so we will have to wait until next month before we can answer some more of the many questions from our readers.

Fundamentals of Model Airplane Building

(Continued from page 13)

shows the usual method of bending wire. The pliers hold the wire while the other hand or a second pair of pliers brings the wire over for the bend. Small circles can be made in this manner. A simple wire bender is shown in Fig. 1-"B."

It consists of a short length of 1" dowel, or a piece of broomhandle, into the end of which two small brads have been driven. The heads of the brads tend to keep the wire in place during bending. Handles may be 6" or 8" long and several such benders may be made with nails of varying diameters for bends of different sizes.

We will need a propeller bearing, propeller shaft, landing skids, two wing clips and an end hook for this model. While the making of propeller bearings will be given at a later date, the one for this model should be purchased, but all other fittings are made. At the top of the plan will be seen how the end hook, wing clips and propeller shaft are bent. Make the under bend in the end hook as shown, thrust it through the center of the motor stick 3" from its trailing end, or ½" in front of the elevator location, and then bend over the protruding end. A drop of cement on this end will hold it in place. Note this in the plans under "Side View" just in front of the rudder.

Bend two wing clips, as shown in the plan, but do not assemble them in place on the stick at this time. The propeller shaft is bent after the propeller has been carved, but the landing gear skid is made now. Note how this is formed in the plans under "Side View" and "Top View." The bend of the skid fits around the end of the motor stick and its ends then slant out and back, as shown. Cement this and the purchased propeller bearing in place. The latter fits on the under side of the stick at its front end. When both fittings have been cemented in place, reinforce them by wrapping silk thread around the stick and the fittings. When the wrapping has been completed, a coat of cement will add strength and cement the thread in place.

Propeller

The propeller for this model is carved from a block of hard balsa wood measuring ¾" thick, 1¼" wide and 8" long. As propeller carving is a step requiring considerable practice, several such blocks should be purchased by the beginner, so as to allow for mistakes and the spoiling of propellers in the process of carving.

Diagonal lines are now drawn across the face of the block, as shown in Fig. 2, Step 1. The general shape of the propeller is drawn on this same face with these diagonal lines acting as edge guides, as shown in Step 2. Step 3 shows the first cutting operation. A sharp pocket knife may be used for this work but a regulation propeller knife will be found best. Such a knife is shown in the illustration and can be purchased at any model supply house. In this first cutting step, the blade attacks the right top edge with a scooping motion to give the cuts a concave form. At Step 4, we see the same operation near the finish, as the knife removes the wood in a concave form which slants from the rear top edge to the front bottom edge. Note the end views of each operation at the right of the illustration.

The blank is now swung around and the knife makes a duplicate concave cut on the other side, or the original left side of the blank, as shown in Step 5. All cutting must be done from the hub (center) of the propeller toward the tips to eliminate false cuts or possible splitting. The hub is left its original thickness while the carving is being done.

At this point both concave cuts have been made, and when the blank is viewed from on top of the hub, both these cut sides must appear on the side of the blank, while the untouched sides will not be seen or will appear on the opposite side.

The blank is now turned over and the convex sides are cut. The start of the first cut is shown in Step 6. These cuts must run parallel with the concave cuts on the opposite side and should be continued until the blade is ⅛" thick, gradually increasing toward the hub. Both sides are cut in the same manner. Following the carving of the blades, the hub of the propeller should be cut away, as this is its most inefficient part. While experts cut their hubs down to ⅛" thickness, the beginner should leave

his not less than ¼″. Step 7 shows this being done. As the shaft of a tractor propeller, such as this one, extends out from the concave side of the blades, it therefore follows that the excess hub material is cut away from that side. Round the blade tips as shown.

Step 8 shows the final sandpapering of the blades. This is an important step. The propeller is now tested for proper balance. To insure even rotation of a propeller, the blades must be exactly the same weight. As it is obviously impossible to weigh each blade, the balance method is used.

A simple balancing block is shown in Fig. 3. It consists of a platform with two uprights of the same length. Into the ends of each a razor blade has been inserted. Piano wire of the same diameter as the intended shaft is thrust through the center of the hub. Make sure that this hole is directly on the cross marks of the two diagonal lines, and that it is inserted perfectly straight. Remove the wire and insert in its place a needle of smaller diameter, so that the propeller will turn easily on it.

File small notches in the exposed edges of the razor blades and then place the protruding ends of the needle in these notches. The propeller should now rotate easily on the needle when blown on. If both blades are of equal weight, the propeller will stay at whatever angle it is stopped in. If not, the heavier of the two will drop down. This blade must then be sandpapered until both are equal.

Step 9 shows the final assembly of the propeller. Bend your propeller shaft, as shown in the plans at the top under "Propeller Shaft." The end opposite the hook is thrust through the hub so that the hook is on the concave side of the blades. Bend the straight end of the shaft around, as shown, and carefully pull it back until the point of the shaft buries itself in the wood of the hub, where a drop of cement will hold it in place.

Assembly

Center the elevator on the under side of the motor stick and cement it in place, as shown in the plans under "Top View." See that the trailing edge of it is at right angles to the stick. The tail skid is now cemented to the under side of the elevator, directly under the motor stick and flush with the trailing edge of the elevator, as shown.

The rudder is cemented to the right side of the motor stick when sighting it from the rear. Its bottom edge rests on the top of the elevator and its leading and trailing edges are flush with those of the elevator. Apply a fiber washer to the propeller shaft, and thrust its hook through the hole of the propeller bearing. Steel washers may be used, but the fiber is recommended.

The final assembly of a propeller is shown in Fig. 4. While this shows the motor on top of the stick, and ours is on the bottom, as shown in the plans under "Side View," the assembly in both cases is the same.

Motor Power

Our "motor" consists of a high grade of rubber strand which, when unwinding, turns the propeller. We will need about 51″ of ⅛″x1/30″ pure Para rubber, which can be purchased at any model supply store. Loop the rubber length and tie its ends together in a square knot, as shown in Fig. 5. Loop this into four strands and place one end of double loops over the hook of the propeller shaft. The opposite end loops are fastened or looped over the end hook, as shown in Fig. 5. A slight "play"

(Continued on page 39)

On the Frontiers of Aviation

(Continued from page 7)

Waco has announced some of their new 1934 models. Two cabin ships are now on the production line, the UKC and the YKC, and also a single place biplane, UMF.

	UMF	UKC	YKC
Length overall	23′ 1¾″	25′ 2½″	25′ 4⅜″
Height overall	8′ 5⅜″	8′ 6″	8′ 6″
Span	30′	33′ 2⅝″	33′ 5⅝″
Pay load	515 lbs.	692 lbs.	745 lbs.
Power plant	Continental	Continental	Jacobs L-4
Horse-power	210	210	225
Fuel capacity			
Gasoline (gals.)	50	50	50
Oil (gals.)	4	4	4
High speed	143 m.p.h.	145.5 m.p.h.	148.5 m.p.h.
Cruising speed	128 m.p.h.	128 m.p.h.	130 m.p.h.
Landing speed	47 m.p.h.	53 m.p.h.	53 m.p.h.
Climb at sea level	1100′/min.	750′/min.	800′/min.
Service ceiling	14500′	13000′	15000′

More new Wacos are to follow.

Col. Roscoe Turner has been flying around the country lately in a new Wedell-Williams racer. Probably before this article goes to press he will have officially broken the world's landplane speed record now held by Jimmie Wedell. Not long ago Roscoe Turner flew from Detroit to New York, averaging 308 m.p.h.! This is 4 m.p.h. faster than the present world record. He was slowed slightly by a fierce dust storm on the latter part of his fast trip. He will probably enter his plane in the London-Melbourne race.

England has become distressed over the increasing development of our aeronautical world trade. The foreign governments are showing a decided preference for our ships instead of the English ships as formerly. Mr. C. G. Grey, the backbone of British aviation, has stated that he fears that the United States will have a monopoly of the world's aviation trade as it already has accomplished in the bicycle and automobile industries throughout the entire universe. Such orders being received here as two hundred American bombers for Spain, purchases by China from United Aircraft, Curtiss and Consolidated worth several million dollars, a Lockheed Electra for France, a Northrop Delta for Denmark, three Boeing 247s, two Curtiss Hawk "Sports," six Vought Corsair mail planes and several Wacos for Germany, a Douglas DC-2 for Holland, a Curtiss Condor and GA-43 for Switzerland, a GA-4 for Japan, Wacos, Fairchild and a Vought for South America, is a very encouraging fact for those in the American aircraft industry. And why shouldn't Mr. Grey be worried!

He has steadily emphasized the fact that England must forge ahead and his efforts are at last bringing about results. The De-Havilland Aircraft Co., Ltd., has produced a two-engined version of the Dragon Express Liner, (four-engined biplane). The plane has two 200 h.p. Gyspy-Six engines, giving it a top speed of 165 m.p.h. It cruises at 140 m.p.h., carrying eight passengers.

England has completed a second four-engined Short landplane named the "Syrinx." It carries 8 passengers at a cruising speed of 105 m.p.h.

Another new ship is the Avro 642 twin-engined, high-wing monoplane. High speed is 160 m.p.h, and cruising speed is 154 m.p.h.

Among new English flying-boats is the new Supermarine "Scapa," a twin-engined, open-sea reconnaissance flying-boat, powered by two Rolls-Royce Kestrel engines. There is provision for a thousand pounds of bombs and three Lewis machine-guns.

The Comper Streak is the latest of the English sport planes. A D. Gypsy Major drives it at a 160 m.p.h. cruising speed.

One of the latest French sport planes used in England is the two-seater, high performance, light, cabin monoplane (low-wing), known as the Caudron 430. Maximum speed is said to be 196.3 m.p.h. and the cruising speed is 161.4 m.p.h.

The latest Australian plane is the Wackett Codock, while in France a new Farman has been produced. Both are twin-engined planes of low horse-power.

Russia's new Maxim Gorky will probably be going through its first test flights as this article goes to press. The plane is about three times larger than any other plane in existence. If the ship gets off the ground, it will be one of the greatest achievements yet accomplished in the development of new type aircraft, for it contains enough equipment to publish a full newspaper in flight. From recent photos received from abroad, the plane seems to be of excellent design. It is a semi-flying wing with small enclosures on the top of the giant wing where mechanics can observe the eight powerful motors. The Maxim Gorky will be used for the distribution of propaganda.

The Northrop Company is now busily working on TWA's order for fifteen newly designed Northrop Gamma mailplanes. The first of the proposed fleet was flown across the continent west-east by Jack Frye, vice-president of the reorganized TWA, establishing a transport speed record for the route of eleven hours and thirty-one minutes. The plane is similar to Frank Hawks' Gamma, except that the ailerons are built into the wings and there is a slight change in fuselage design.

Build a Solid Scale Model of the Douglas Y10-43

(Plans, Page 8)

Each part of the plane is made in the

same manner. Draw outline of piece on stock and cut to shape with jig saw. Then finish up the parts with a sharp chisel as shown by the numerous cross sections on plans, page No. 8.

The cockpit enclosure is made of strips of wood cut with a razor blade and ambroided together. Isinglass may be used.

Dope all parts before assembling. The wings and horizontal tail surfaces should be yellow, the rest of the plane olive-drab with the exception of the insignia and the three-bladed prop. The circle within the star of the wing insignia should be red, the star white, and the rest blue. On the rudder, the vertical strip should be blue and the seven alternating horizontal bands red, the others white. Paint the prop silver.

Ambroid the wing to the fuselage after the paint has dried by means of the four wing struts. Hold the wing in place with small blocks. Join rudder and fin in place next and then the elevators and stabilizer, to the fin. Connect all struts and proceed to put on landing gear, using plenty of ambroid.

Ambroid prop blades in place on nose of fuselage and put in all wire bracing, using black thread.

The small object protruding above fuselage near tail is clasp for machine-gun muzzle when not in use.

Connect air speed indicator to wing as shown. After touching up all parts, the model will be completed.

Fundamentals of Model Airplane Building

(Continued from page 37)

will be found in the rubber, which is allowed for surplus winding.

The wing is now assembled on the top of the motor stick. The mounting stick is placed on top of the motor stick with the two sides of the mounting assembly fitting over the sides of the stick. The two wing clips are now placed around the under side of the stick, so that their small hooks come above the top of the stick. They are placed in front and back of the mounting stick, as shown in the side view of the plans.

Two small rubber bands are used to hold the mounting stick in place on the motor stick. Loop them between the hooks of the clips until tight. In the plans under "Wing" is shown the proper center of gravity point by the letters "C.G." The wing with its mounting and clips must be moved forward or backward along the stick until the model balances evenly on this point. This completes the model.

Flying

The usual right-hand propeller, such as this model is equipped with, turns counter-clockwise when viewed from in front, and must be wound therefore in the opposite direction or clockwise. Hold the model in your left hand so that the propeller is facing you and with your right hand wind the propeller clockwise. Give it about two hundred turns to start with.

Holding the propeller with the left hand to prevent it from turning, place the right fingers around the stick just below the wing. Place it above your head, level with the ground and release it with a slight push dropping both hands away at the same time.

Building Models for the Tunnel

(Continued from page 5)

by a suspension wire, contact is made with an electric circuit. On the arm is mounted a small motor. The closing of the circuit starts the motor revolving. It then drives a threaded shaft which in turn moves a counter or balancing weight. The beam oscillates up and down a short while and a revolution counter connected with the motor gives the observer his reading of lift, or drag or side force. The balances are almost uncanny in the rapid and unerring manner in which they work. Directly or indirectly it is possible to measure not only the three forces of lift, drag and side force in any attitude of the model, but also the three moments: the pitching moment, which noses the machine up or down, the rolling moment which lowers or raises one end of the wing, and the yawing moment which turns the airplane off or on to its course.

Keeping the Air Speed Constant

Another very important point in wind tunnel technique is keeping the air speed constant.

Suppose the direct current motor which drives the propeller were connected directly to the Edison Company's electric mains. If it suddenly became dark and all the consumers turned on their lights rapidly—the voltage in the outside electric cables would fall somewhat, the propeller motor would slow down and the man working the wind tunnel would be seriously embarrassed. He relies on a constant propeller speed and a constant air speed in his tunnel.

This difficulty is surmounted by the same principle that is employed in the splendid electric clocks that make such welcome Christmas presents! A synchronous motor is connected to a 60 cycles per second outside circuit. A synchronous motor always runs at the same speed. As long as the Edison power station is delivering current at 60 cycles per second, the synchronous motor keeps exact step.

The synchronous motor always turning at a constant speed, drives an electric direct current generator (see Fig. 7) at a constant speed. The generator then delivers a constant voltage to an electric motor, and the electric motor receiving constant voltage, in turn keeps the propeller running at a steady number of revolutions per minute. This reminds one a little of the inventions in the comic section of the paper, where the cat licks up the cream and changes the weight of the saucer, which in turn releases a spring, which lets a weight pull down a window while a man stays lazily in bed! But such an arrangement is absolutely indispensable.

Measuring the Air Speed

It must not be thought, however, that the wind tunnel worker has no control over the air speed. On the contrary, by manipulating a rheostat he can change the field in the generator and get any air speed he wants between say 15 and 115 miles per hour. He must, however, be able to measure the air speed. Such measurement is very readily made. At the side of the tunnel wall in the working section, a pitot static tube is placed with small openings

into the wind stream. The faster the air moves in the tunnel, the greater the suction at this plate. The pitot is connected by a length of tubing to an inclined glass gauge containing colored alcohol at its reservoir (see Fig. 8). The suction of the tunnel side plate draws the alcohol up the sides of the glass tube, which is carefully graduated in miles per hour for the observer to note.

Uses of the Tunnel

In the hands of skilled operators, the tunnel can be made to answer a diversity of questions: How fast will the airplane fly? How slowly will it land? If a gust noses it down, will the machine come back without intervention by the pilot? It is fascinating to put a new and untried model through its paces and to give the careful designer constructive criticism and help toward the production of a perfect flying machine.

All this is predicated, however, on the construction of an accurate model, light yet able to withstand the effect of a powerful air stream. We all know the power of the wind, but nothing gives one so vivid a sensation of air power as to open a window and put one's head in the channel.

The Streamline Age

It may be of some interest to point out that while the wind tunnel was originally solely intended as an aid to the design of flying machines, airplanes or airships, its applications have now gone into other fields of transportation. For example an almost completely streamlined car will be shown at the next automobile show, which was refined step by step in the wind tunnel. At 60 miles per hour, almost two-thirds of the gasoline consumed goes into overcoming air resistance, so that streamlining is well worth while. The newspapers have also carried announcements of streamlined trains which will travel at a hundred miles per hour, and these also have been developed in the aerodynamic laboratories. Ships designers are also making studies of the resistance of the superstructure in the wind tunnel. Thanks to the airplane and the rapid development of aerodynamic ideas, we may say that the streamline age is now upon us.

Part No. 2 of this article will appear in the next issue of this magazine. It will deal with the construction of a good wind tunnel model. To make a first class model of this sort is a challenge to the skilled flying model builder.

The Aerodynamic Design of the Model Plane

(Continued from page 25)

raised. In this set up, the force on the stabilizer and its distance from (G) (moment arm) remain the same. Therefore, the righting moment is the same in both thrust line positions.

However, what about the righting effect of force (H)? By examining Fig. No. 105, it can be seen that it has changed its position in the diagram to (H_1). The moment arm of (H) acting about (G) was distance (E). Now however, the moment arm of (H_1) about (G) is distance (D), which is greater than (E). Therefore, the corrective moment (H_1-D) is greater than moment (H-E). In other words, the corrective moment of the thrust component is greater when the thrust line is high than when it is low.

Our reasoning here demonstrates that a high line of thrust relative to the center of gravity increases the righting moments as well as *decreasing* the disturbing moments, and therefore contributes substantially to the longitudinal stability of the airplane. This is of course true under the condition that the various other features of the design of the plane are not changed.

We may summarize the situation by saying that at every particular angle of climb the disturbing moments are less and the righting moments are greater when the line of thrust is high than when it is low.

An example that will demonstrate our findings conclusively is one in which we assume that the plane is in the most extreme stalling position, that is, nosing straight upward as shown in (A), Fig. No. 106. In this case the line of thrust is low, below the center of gravity (G). It can be clearly seen that the thrust (T) upward and the pull of gravity (G) form a couple or moment which tends to turn the plane over on its back instead of returning it to its level flight position. The arrow (X) indicates the direction in which the plane will turn.

I have actually seen planes, designed with this force set up, turn over on their backs from a steep climb and fly upside down. A good way to cover a mistake of this kind is to call the model a "stunt" plane for it will surely "stunt" very well.

This has really been done by some frantic and bewildered model manufacturers.

The solution of the problem is quite simple. Suppose the line of thrust (T) is placed high relative to the center of gravity (G) as shown in (B), Fig. No. 106. It takes very little observation to see that this set up forms a righting couple. The forces will tend to nose the plane over in direction (X′) back into normal flight position again.

We have shown that the disturbing moments are less for any given angle of climb when the line of thrust is high. Now let us see how they *change* relative to one another as the angle of climb increases from zero. This aspect of the problem will also give us an idea as to the value of a high line of thrust.

The heavy lines in Fig. No. 107 show a plane in level flight, which has a low line of thrust (T-T′). Now, as the angle of climb increases, the vertical component of the thrust increases, tending to pull up the nose more with each degree increase in the angle of climb. Not only is this true but the moment arm increases from length (A_1) to (A^1) when the plane reaches the position shown by the dotted climbing position. Due to this, the disturbing moment increases, causing greater longitudinal instability. When the dotted line (BG) reaches a horizontal position shown in the figure, the disturbing moment due to the lengthening of the moment arm, reaches a maximum. If the plane assumes a stalling position of greater degree, the moment arm (A^1) becomes smaller as indicated by distance (C). However, the vertical disturbing force (V) is becoming greater. This more than outweighs the effect of the shortening of the moment arm and the increasing effectiveness of the horizontal component (H) to right the plane, due to the rising of (H)'s point of application (B). This effect also is more than outweighed by the fact that its *intensity* rapidly *decreases* as it rises.

What happens when the line of thrust is high as in Fig. No. 108? The dark lines indicate the plane in level flight position. Suppose now the climbing angle of the plane increases until it reaches the dotted position Fig. 108, which is the same angle of climb shown in Fig. No. 107.

Upon examining the diagram you will note that as the angle of climb increases, the moment arm (A) grows *smaller* instead of larger as in our previous example, until it reaches the position indicated by the dotted lines. The moment arm is then equal to (A′) which is much shorter than (A). Thus the disturbing moment (VA) grows *smaller* as the angle of climb increases. This is a desirable condition and in itself justifies a high line of thrust.

The facts brought to light in this analysis explain the mystifying actions of contest models designed with the line of thrust below the center of gravity. If you carry on a careful experiment with such a model, you find that it will climb well until the ship reaches a certain angle of climb, it will then hesitate, the nose will rise and the whole plane tail slide. The action is caused by the model reaching the climbing angle at which the disturbing forces have reached a maximum relative to the righting forces, the disturbing forces suddenly increasing and the righting forces decreasing.

Of course, if the model is adjusted so it

will not reach this degree of climbing angle, it will fly perfectly, but the point is that a model of this type *will not be able to climb at as steep an angle* as one with the thrust line high, and yet retain its longitudinal stability. Also, a much smaller stabilizer may be used on models with high thrust lines, for any degree of desired longitudinal stability.

In the formula for correct stabilizer area given on page No. 45 of the June 1933 issue, this condition is taken into account. The expression

$$\left(1 - \frac{(G + 2T)}{4C}\right),$$

causes the formula to give the correct amount of stabilizer area for any position of the center of gravity or line thrust.

The complete formula is:—

$$As = \frac{A}{3M}\left(\frac{3C}{2} + N\right)$$

$$\text{times}\left[1 - \frac{\left(Q + \frac{2X}{M} - 2\right)}{5}\right]$$

$$\text{times}\left(1 - \frac{G + 2T}{4C}\right).$$

In the Formula:—

As = required stabilizer area in square inches.

A = Wing area in square inches.

M = stabilizer moment arm in inches.

C = chord of the wing in inches.

N = distance from the center of the wing to the tip of the fuselage nose.

Q = the difference in angle between the stabilizer and the wing.

X = the vertical distance from the line of thrust to the wing center section.

G = the vertical distance from the center section of the wing to the center of gravity.

T = the vertical distance from the center of gravity to the line of thrust.

This concludes our chapter on the stability of the model plane. In it we have defined our problem, given the facts of design with simple rules and formulas for their practical application, and finally, an analysis of the principles underlying the facts given. A complete summary was also given for your ready reference. This gave important practical information in concise form for those who are practical designers. It was published in the September and October issues, 1933.

The author sincerely hopes that his meager efforts have been of some value in helping you produce better model planes and in increasing your general knowledge of the principles of stability.

In the September issue of* Universal Model Airplane News *the author takes pleasure in announcing that the first article on Chapter No. 4 will appear. This chapter will deal with "Motive Power."

How the Aeroplane Was Created

(Continued from page 24)

they were all monoplanes with the same fine streamline design used in former Nieuports. Being small, they were well adapted to the acrobatics necessary for combat work and a later model biplane became one of the mainstays in the Allied defense in air.

The German defense relied on the Taube and Etrich in the earlier days of the conflict, but so badly were they out-performed, that a new group rapidly took their places. One other early model was the Grade, designed by H. Grade, who was the first to fly a German-made machine in Germany. Soon an entirely new group of machines began to show up along the German lines. Among these were the Halberstadt, Gotha, Rumpler and D.F.W. But the more important ones included the Aviatik Albatros, which was an outgrowth of the Taube and Etrich, the Heinrich, and most important, perhaps, the Fokker.

The Gotha line of machines upheld the group comprising the observation and bombing planes, while nearly all the others were smaller pursuit and combat ships. The Fokker was the lightest of the German types and was equipped with an Uberursel rotary motor and the earlier models, not having ailerons, were somewhat difficult to manage. Practically all the other groups were heavier than comparative Allied machines and this was generally characteristic of the German ships.

Despite this, the Allies soon found that Germany was developing flying machines of excellent performance and they were sorely tried attempting to maintain supremacy in the air.

The Albatros, also one of the fine machines developed by Germany during the early days of the struggle, was noted for its clean design and performance. It was equipped with a four cylinder Mercedes motor, water-cooled by a radiator on the left side of the body.

Anthony Fokker, the Dutchman, had offered his machines to the French and English governments during the very early days of the war and at their refusal, he negotiated with the German High Command, his offer being quickly snatched up. The Allies later had much to regret in their mistake, for Fokker's products gave them grave concern, and a still better account of themselves.

With the entrance of Turkey and Italy into the war, fighting soon spread to the many corners of Europe. This called for better seaplanes with wider range for patrolling the smaller waters, as well as the Mediterranean, Bosphorus and North Sea. This demand was somewhat alleviated by the presentation of the new Short Seaplane from England. This seaplane was larger than the general types in service up to this time, and consequently boasted of greater range. It had a wing spread of fifty-six feet and was powered with a rotary motor; there was also place for an observer. A feature of this model was its folding wings which hinged back parallel to the fuselage, permitting storage in a fairly small space, thus enabling storage on ships for transference to special sectors quickly.

Although England had been develop-

Next Month . . .

One of the most interesting features of our next issue will be the tabulation of the results of the National Model Airplane Contest held in Akron, Ohio, June 27-28-29 under the sponsorship of the Akron Men and Women's Chapter of the N.A.A., the Akron Chamber of Commerce and Universal Model Airplane News.

Our old friend, Lt. H. B. Miller, is back with us once again presenting the first of a series of articles entitled "Acrobats of the Sky."

Next month our Editorial columns will also carry contributions from Alexander Klemin, C. L. Bristol, Robert C. Hare, Edwin T. Hamilton, Chas. H. Grant, Robert C. Morrison and David Cooper.

ing Bleriots, Caudrons and Farmans under licenses from French companies, there were others in Great Britain making fine machines also. Avro, Sopwith, Short and Blackburn began manufacturing training ships and faster pursuit jobs, but the government took a hand and through a reorganization, new ones came in and others were subsidized or combined. There appeared Boulton and Paul, Armstrong-Whitworth and Vickers who built larger aeroplanes for bombing and observations; later Handley-Page joined in this particular kind of construction.

Thus it was by government control that actually better equipment became available by constant improvement and benefiting by results obtained under actual conditions. By pooling these ideas for the common good, each factory still was able to continue its own individual research. By the middle of 1915 these units were fairly well organized. Incidentally, many of the French and English flying boats in the early days were constructed by Curtiss and Benoist in this country.

Italy, until the opening of the war, had been manufacturing Nieuport machines in the Macchi plants, Farmans in the Savoia plants and Bleriots under S.I.T., at Turin. Improvements were made, however, and there soon appeared on the frontier the new Antoni and Cheribiri; but without doubt the best Italian contribution was the Caproni. This was at first developed as a huge biplane but later changed to a still larger triplane. It was characterized by its ability to transport enormous loads over long distances. Russia of course lagged much behind, being supplied with equipment by her allies, but they did contribute a wonderful ship in those days, in the well known Sikorsky.

Vickers Ltd., of England, heretofore manufacturers of munitions, were drafted into service and began making aircraft also, and then turned to the special development of n .chine-guns to be mounted on planes.

The first machine-guns were mounted by the French and were operated by the pilot or his observer. In the French method, they were placed on the fuselage cowling and were fired through the propeller. Metal strips were riveted in the propeller to avoid tearing them to pieces, since some of the bullets struck the revolving blades while in motion. However, this was later avoided by synchronizing the machine-gun fire through the blades, accomplishing this by means of a cam control operated on the motor shaft. Usually the gun was triggered by a control on the joy stick on the plane, this latter scheme being copied from a captured German plane.

These various improvements were made mostly during the year of 1915 and it must be noted how rapidly both participants made use of their experiences to improve their air forces, all the while aware that air sumpremacy was the key to victory.

Although America in the early days of the war was neutral, nevertheless, American factories were keeping pace in the development of certain types of fighting ships, a few of which were the Curtiss J.N., now world-famous for training purposes; the Sturtevant, by G. C. Loening, equipped with two battle turrets for gunners in both wings; and the Thomas-Morse Scouts.

With the bottling up of the German Naval strength in the North Sea, there was need of observation, and English flying boats and seaplanes had this duty to perform. In the Dardanelles in 1915, the German cruiser Konigsberg was destroyed by gunfire directed by aeroplanes.

Thus, you can see how very rapidly the aeroplane took its place of prime importance in practically every sphere of war activity; in observation, signalling, bombing, and even later strafing troops in trenches with machine-guns.

In the use of the larger planes for observation and bombing, they were usually accompanied by smaller and faster planes for protection against the enemy, who were always on the lookout to destroy, and then run again behind their own lines. France soon learned that they were vulnerable to air attack and Paris had its trained "flight" to beat off attacks of this kind.

The great speed at which the World War was fought demanded rapid changes in all manner of aircraft, and with these changes came great improvement in streamlining, armoring, speed, maneuvering and high climbing ability. During this struggle, machines were called upon for more rigorous service than could ever be demanded in peace times and doubtless the war advanced the development of aeronautics many times more than normal times did.

Though many had thought that the World War would retard rather than stimulate aviation, it was found that the war gave a real impetus to aeronautics. Indisputably, before the summer of 1914, aircraft had demonstrated little practical utility, being more or less an open air circus stunt. True, wonderful flights had been made, distances covered and high altitudes reached; still, the general public though thrilled, were thoroughly convinced that air travel would never be safe for the common man.

Contrast this with just the first two years of the war; certainly the reliability of planes had been greatly extended and noted improvements had been made in ability to climb rapidly and carry heavier loads, to say nothing of such improvements that made possible clever maneuvering. The ratio of weight to engine horse-power had been materially lessened, as had the parasitic resistance, due to careful streamlining.

All this has to do with today's aviation, for by this simple comparison one is enabled to understand how far flying had progressed in a comparatively few years. As the succeeding years of the war are covered, this becomes more apparent and the next year, 1916, brings still more wonderful advances in both aeroplanes and skill of pilots flying them.

Next month David Cooper continues his interesting series, "How the Aeroplane Was Created."

Build a Flying Model Beechcraft

(Continued from page 17)

I-Strut

Make two I-struts as shown from HARD balsa 1/8" thick, sanding to a streamline shape.

Cowl and Motor Tube

We believe we are the first to use in plans for public use, a motor-tube in this type of model. While the tube is about twice the weight of the motor stick, it more than justifies its use by the protection it affords the fuselage from rubber breakage, which happening in a fuselage using a motor stick, it is sure to break the covering or bulkheads. It also improves the appearance of the inside of the model and perhaps the rubber, being enclosed and thus protected from dirt, light and air, will last longer than when in the open.

Construct motor-tube of 1/16" stock. (Note 1/16"x1/8" inside rear end). Cut cowl bulkheads No. 1 and No. 2 from 1/4" balsa. Glue together with grain crossing. The round hole in No. 1 should first be sanded smooth and round and the square hole in No. 2 should fit the front of motor-tube snugly. Glue this unit on the front end of the tube with the end of the tube flush with the front of No. 2. (Make sure the unit is at right angles to the tube).

Cut No. 3 from 1/16" stock and glue to motor-tube in position shown. Next cut four cowl covering pieces and glue around the bulkheads. Sand smooth to size and shape. Glue one-half of a dress snap (large) to rear of bulkhead No. 3 (cowl), as shown.

Front and rear motor plugs are made as given, of HARD balsa. The wire hooks are made now and the rear one placed and glued to the rear plug while the prop shaft is laid aside for a while. Make the six riding lights. The exhaust ports are left flat, top and bottom.

Fuselage (Plates No. 4 and No. 5)

First cut Plates No. 4 and No. 5 and join at A-A and B-B respectively. Make upper and lower keel as shown by heavy lines on side view. Glue half of tail wheel enclosure to keel and after keel is dry, remove from layout and glue other half of enclosure in place. Cut out patterns for bulkheads. (Whenever patterns are used it is best to paste the whole sheet to heavy paper or light cardboard and then cut the pattern out). Cut the bulkheads from 1/16" stock, gluing two pieces together whenever necessary to get the proper width.

Place balsa braces across bulkheads where indicated and see that square holes in No. 1 and No. 5 fit motor for a sliding fit. Mark position of bulkheads upon the keel in soft pencil. Glue them in places marked, starting with No. 9 and working forward to No. 5, making sure they are perpendicular. From No. 5 forward, there is no upper keel so bulkheads must be glued to lower keel only, being certain they are lined up properly.

Trace and cut wing stub rib as shown on side view, marking in pencil the position of the bulkheads; then glue ribs in place. (This must be done with care or the wings will not line up properly). Next glue center side stringers in place, beginning at No. 1 bulkhead and working aft. Now glue all stringers in place (stringers are all 1/16" sq.), putting first one on one side, then one on the other. This will keep fuselage from going crooked. After all stringers are in place, glue diagonal braces in place.

Glue instrument panel to a piece of 1/16" stock, cut to shape and glue in place in fuselage. Cut from 1/16" stock door frames and top of cabin and cement in place. Cement windshield visor (so called for want of a better name), into proper position and then cement 1/16" windshield frames in place.

Before gluing second half of dress snap in place on No. 1 bulkhead, be sure that motor tube slides in place and lines up correctly. If it does not, the bulkheads should be cut away or filled with thin pieces of balsa until a correct fit is obtained. Now place two pieces of tissue over the half of snap on cowl and push other half of snap over this paper. (The paper prevents the two halves from being glued together). Coat the rear half of snap liberally with cement and push cowl back into position against fuselage and set aside until dry.

Make front and rear wing fillets. (These are on bottom wing only). These must be cut to fit your model and when dry they are cut and sanded to a nice streamline shape. Now take a piece of

(Continued on page 45)

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Air Ways—Here and There

(Continued from page 16)

it seriously, judging from the expression on his face.

A view of another very important event is shown in picture No. 7. Phil Zicchitella is weighing in one of the models, to be sure that its weight checks with the wing area. The contestant whose model is being weighed is John Haw. This picture is interesting in another sense. It portrays vividly the many emotions which enter into a model airplane contest. Miss Walker, at the right, typifies extreme amusement and Mr. Zecchitella, intense concentration. The little fellow with his elbows on the table unquestionably is envious and curious to see the result of the weighing. The young man on the extreme right seems to be skeptical over something and the young contestant waiting in line, we would say, typifies steadfastness and determination. He seems to say, "I am going to remain here if it takes all night." Well, enough of philosophy.

We now come to picture No. 8, which shows Miss Barbara Maschin, the only girl to enter the contest. Miss Maschin is an experienced model builder from Westfield, Mass.

Among the people who were kind enough to render their services as timers and judges were:

Mr. Walen of Springfield, Mass.: Mr. Cutting of the National Model Aircraft & Supply Company, New Rochelle, New York; Mr. Phillip Wagner of Newark, New Jersey; Mr. H. Sichler of Newark, New Jersey; Mr. Alfred Langberg; Mr. Phillip Zicchitella of the Bamberger Aero Club, who was one of the hardest working officials at the Meet. To him we extend our greatest appreciation, also to Miss Mary Walker, Mr. Leonard Skolnick, Mr. Harry Pack, Jr., and Mr. I. Block. Mr. Broadfield Billings of the Broadfield Model Airplane Company flew all the way from Garden City to lend a hand. Percy Pierce came out of hibernation from Philadelphia. He has been very reticent about showing his face at contests outside of his home town. Mr. Aaron England of the Westchester Flying Club also rendered great assistance. Several others gave help and to whom we wish to extend our appreciation. However, they made this impossible by not signing their names to the time cards as requested, so we cannot tell who they are.

The Meet was directed by Mr. Irwin Polk, director of the Bamberger Aero Club, and Mr. Charles H. Grant, editor of UNIVERSAL MODEL AIRPLANE NEWS.

In telling about this most important contest, we have not forgotten our individual contributors to Air Ways. Orval Lloyd of 317 Templeton Building, Salt Lake City, Utah, has submitted a picture of his flying scale Boeing Transport 247. It is the best looking flying job of this plane that we have seen. It is built to three-quarter scale, having a wing span of 55⅝". It weighs about eleven ounces. This plane is shown in picture No. 9.

Next we have a picture, No. 10, of Henry S. Hughes' gas job. He lives at 2215 Oh Street, Sacramento, California. This ship is unusual because it is one of the first low-wing gas jobs to be built. The ship has an eight foot span and weighs about 3 pounds. Hughes tells us that this weight is a guess on his part as he has no scales. It is covered with silk and Jap tissue. The frame is of pine and spruce. The motor mount is made of cast aluminum made in Mr. Hughes' own foundry. All fittings are of duralumin.

One of the finest looking gas jobs to come to our attention, and incidentally it gives an excellent performance, has been built by Irwin G. Ohlsson of 1437 Bellevue Avenue, Los Angeles, Calif. Ohlsson and his plane are shown in picture No. 11.

In picture No. 12 it can be seen climbing for altitude after a take-off. The ship has a span of eight feet, a chord of sixteen inches and weighs seven pounds. It has a one cylinder, two cycle motor which turns a twenty inch propeller at two thousand one hundred fifty revolutions per minute. The thrust is approximately five and one-half pounds and the flying speed is about forty miles per hour. The construction consists of a balsa frame covered with silk. As can be seen, the motor is completely cowled. The whole plane has an unusually fine finish. Ohlsson hopes to be able to attend the National Contest at Akron and enter this ship in the competition.

Mr. Henry Garttmeyer of 46 Fort Washington Avenue, New York City, deserves a lot of credit. He has built a very fine Ford Trimotor, shown in picture No. 13, from miscellaneous information and material which he has picked up here and there. He had no plans from which to build the ship, but spent a few minutes taking notes of the Ford airplane on exhibition at the Pennsylvania Railroad Station, New York City. This ship is complete in full detail, including movable controls operated from the central compartment, and a complete lavatory. The realistic effect is ingeniously obtained by having the props turned into the wing which is causing them to spin.

Jack Coppages of 518 Rankin Street Northeast, Atlanta, Georgia, has been kind enough to contribute picture No. 14, which shows his Gee Bee Super Sportster, which won first prize in the scale contest held by the Atlanta Model Airplane Club on March 31st.

One of the most valuable contributions this month has been made by Mr. William T. Howell of 9202 Hayes Blvd., Detroit, Mich. It is picture No. 15, which shows an exact detail scale model of the Curtiss NC4 trans-Atlantic flying boat. This is a beautiful job. We say this with emphasis. Ships of this type with many guy wires are most difficult to build, as experienced model enthusiasts well know. Its builder's name may be Howell but he does not have to say a word. His models shriek his praise.

Picture No. 16 shows some intense action. Don Sogard's Yellow Bird low-wing monoplane is shown "going places." Sogard lives at 2175 Chestnut Street, Long Beach, Calif. The plane was designed by Harry Martin of 1941 Olive Avenue, Long Beach, Calif. The picture is of great interest as it shows a common incident in the life of the average model builder. The plane has a wing span of forty-three inches and it uses a pine propeller eleven inches in diameter. It flies consistently from four to six hundred feet.

CLUB NEWS

Fleet Experimental Club

Through some oversight, copy which had been prepared for the Fleet Experimental Club of 344 Sixth Avenue, Brooklyn, New York, was omitted from the issue of the past month. Mr. John O'Reilly, past president of the Club, writes us telling us about it. This club was organized in November, 1932, and has been active without cessation ever since. It has a membership of eighteen active members. There seems to be a real interest in this club for Mr. O'Reilly writes, "The Club held its first official Club Party on April 21st at my home. Sixteen members and their girl friends

(Continued on page 46)

Build a Flying Model Beechcraft

(Continued from page 43)

5/0 sandpaper and sand the whole fuselage, taking all bumps and hollows out. This leaves the fuselage ready for a nice covering job.

Tail Surfaces (Plates No. 4 and No. 5)

All details for the construction of tail surfaces are shown on drawings. The larger tail is recommended for a flying model and it can be built of the same size materials as the exact scale tail, or it can be made of 1/16" sq. (the rounded parts cut from 1/16" stock). Before covering fuselage the stabilizers should be glued in place. Glue No. 8 and No. 9 jig patterns to scrap 1/16" balsa and cut out. Pin No. 8 jig directly over No. 8 bulkhead and No. 9 jig over No. 9 bulkhead, being sure they are centered on the top stringer of fuselage. Glue stabilizer against fuselage side (all necessary trimming of stabilizer for a good fit against fuselage should be done before gluing), putting top of stabilizer against bottom of jigs. This is a simplified and successful method worked out for lining up the empennage on oval or round surface.

Covering

Cover all surfaces with a medium weight tissue, using banana oil as the cement. Do not try to cover too large an area with one piece of tissue as this leads to a wrinkled covering.

If a nice finish is wanted, cover the cowl with tissue as you did the pants; the motor-tube should be covered with a single piece of tissue wrapped tightly around it. In covering balsa parts, a liberal quantity of paper cement should be used and all wrinkles smoothed out with the fingers.

The side cabin windows should be put in place at this time; these are of light celluloid glued in place on the inside. The windshield is put in place after all coloring is finished.

When attaching wings, etc., whenever paper intervenes, it should be removed before gluing, otherwise the joint will not hold well.

Assembly

Glue upper wing to top of top cabin frame and then attach lower wings to wing stubs, placing I-struts in position. (Cut paper from points of wing ribs that glue to struts). If you built the fuselage correctly, the wings will line up perfectly.

Pants are attached in position shown by dotted lines in side and top view of fuselage, using a liberal amount of glue.

Wherever two surfaces meet and make a sharp corner, paper or balsa fillets can be made if wanted. Fasten rudder in place. Run brace threads for tail as shown in side and top view.

For wing bracing, run two threads 1/8" apart, from top of I-strut, in front, through bottom wings through spot marked "X" on pants, to top of pant on opposite side. Then run two threads from fuselage at top of No. 3 bulkhead to bottom of I-strut, one at front and one at rear. (These are the landing wires and are single not double as are the flying wires).

The riding lights are now colored and placed. Color two red, two green and two white and place them on the right wing tip, left wing tip and rear of fuselage respectively in dotted position.

Propeller

We used a C-D fibre propeller on the test model as we believed it to be the best type for this kind of model. However, if you wish to carve a prop. from balsa, a block 1½"x¾"x7" will be about right. No two models fly the same with the same propeller, so we suggest you try several different ones on your model.

Power the model with about 8 strands of 1/8" flat rubber. This amount was found to be best on this model.

The scale propeller is clearly shown on plans.

Doping

The model photographed was doped with two coats of C-D enamel dope, being colored red with black scallops and a thin line of white between the two colors. The design for this is almost impossible to give on the plans so you should follow your own ideas in the matter of coloring.

Flying

Would advise you to allow the model to R.O.G., as in this way, the model gets a perfect start. Model should be flown on calm days only. You will find that with the scale tail surfaces, the model is rather tricky. The flying tail surfaces are much better in this respect. The model is extremely sensitive to the controls.

The Albatros Fighters on Parade

(Continued from page 10)

er" which served only when the pilot was sighting the bead of his gun sights on the victim.

The wing structure of the D-5a was identical to that of the D-5. The upper wing, however, was set down yet closer to the fuselage affording better visibility. This new arrangement made the D-5a even shorter in height than the D-3. The conventional "Teves-Braun" radiator, as in the D-3, was also set into the right side of the upper mid-wing section. The wing struts were identically of the same design as those employed in the D-3 and D-5 but for the exception of the points at which these were shortened.

The wings were then braced with two sets of wires on each side, arranged in V fashion conventionally as in the D-3 and D-5, but one more bracing wire was added to brace the V struts on each side. The mid-wing section struts were likewise braced, and finally, two other wires braced the entire wing structure to the nose of the machine.

The tail section of the D-5a also served conveniently to identify this machine when flying at a distance. The elevator and horizontal fins were the same as the D-5 employed. The vertical fin and rudder, however, presented a new outline. Whereas the D-5 rudder was vertically straight edged at the rear, the D-5a vertical fin was slightly shorter in height and the rudder was curved at the rear tip with a comparative resemblance to a semi-oval outline.

The landing gear on this machine was the same in dimensions as the D-3. The track, however, was set down to 1717 millimeters. The axle in this instance, ran through an auxiliary wing which in turn was attached to the axle. Divided in two halves, this little wing was actually controllable, the axle serving as the axis.

Unlike the auxiliary wing on the Fokker landing gears, this section which was intended to lift the weight of the landing gear, was in the D-5a independent of the struts. Spiral springs were still used as shock absorbers, these being encased in a protective canvas casing.

In unison, the Albatros D-3, D-5 and D-5a had marked down a considerable service record. Fighting veritably side by side, these machines had served to increase the confidence of the German Imperial Air Service officials in achieving the supremacy which was so desired, but the Albatros-Werke was not to rest on its laurels brought by the D-5a. Greater heights would be attained, and with this initiative, the Albatros triplane was introduced.

The Editor will appreciate a letter from any reader who finds this series of articles interesting.

Illustrated Aviation Dictionary

(Continued from Page 22)

axes. The aim of the autogiro is to land and take off almost vertically.

41. **AVIATOR.** One who operates an airplane and makes a study of the art of flying.

42. **AVIATRIX.** A woman who operates an airplane and makes a study of the art of flight.

43. **AXIS.** See *lateral axis, longitudinal axis, vertical axis, wing axis, fore-and-aft axis.*

44. **BACK WASH.** The blast of air driven to the rear of an aircraft by the revolving propeller.

45. **BANK** (verb). To incline an airplane laterally by rolling it on its fore-and-aft axis. "The plane banked to the left."

46. **BANK** (noun). The position of an airplane when its lateral axis is inclined toward the earth. To make a left bank the plane must be inclined to the left with the left wing down.

Air Ways—Here and There

(Continued from page 44)

attended." (This is an idea to attract members, which might be of benefit to other clubs—Editor). "The ceiling was completely hidden with the many models built by the members." Otherwise we might say the visibility was poor and that all members were grounded for the party because of poor flying weather.

A dual contest is being planned with the Foreign Legion Model Club located near 18th Street, Brooklyn. This contest will probably take place on Armistice Day in Prospect Park, Brooklyn. We sincerely trust that the membership of this club will be lenient in their opinion regarding our neglect in printing a report of the Club.

Baltimore Exhibit

Model builders of Baltimore, Maryland, have been quite active lately. An aviation exhibit was recently held under the sponsorship of the Burd Model Airplane Supply Co., of 330 Park Avenue, Baltimore, Md., at Hecht Brothers Department Store. The models were supplied by some of the country's leading model builders and consisted of solid scale models and flying models. It is estimated that about five hundred thousand people attended the exhibit during the week. According to this, it seems that Baltimore is stepping along pretty fast.

Amarillo Model Aero Research Club

Another state has been heard from. The Amarillo Model Aero Research Club has been established in Amarillo, Texas. Thomas Montgomery is the president. He lives at 2504 Fillmore, Amarillo, Texas. He asks if other clubs will write to him and let him know what procedure they use in running their club. He will answer every letter he receives. They are planning to start the club as a National Aeronautical Association chapter.

Cheyenne Model Airplane Club

For several years Mr. Charles Bristol of 1122 W. Pershing Ave., Cheyenne, Wyo., has been preaching model aeronautics to the young men of Cheyenne and to members of the Chamber of Commerce. He has been rewarded finally by the formation of an active model club consisting of forty members. Meetings will be held every Saturday afternoon at the Chamber of Commerce Building and application for junior membership in the N.A.A. has been made. Mr. Charles Bristol is an exceedingly fine designer of model aircraft and the history of this club should be punctuated by many startling performances under his guidance.

Geneva Model Airplane Club

We hear from another club which has been keeping its activities dark during the past year. Recently a contest was held in the State Armory in Geneva. The Auburn Model Club was represented by Ernest Germano. High point winners were:

1, Harold DeBolt, 75 points; 2, Don Mahoney, 25 points; 3, Ernest Germano, 20 points; 4, Bus Meyers, honorable men-

tion. N.A.A. rules were used. Another contest was held outdoors on June 2nd.

The Hawk Aero Club

Many readers have wanted to know how to form a club. Recently, we received a letter from J. H. Chapman, Commander of the Hawk Aero Club of 734 Hill Street, Atlanta, Georgia. It shows how an ambitious and progressive group of boys have worked out their problem. The best way to tell you what they are doing is to let you read the letter, which is as follows:

"Three months ago several boys and I decided to form a model airplane club. We started having our meetings at school and as we grew in size we had to have a larger club room. We went to our advisor and presented the question to him. He very quickly solved it by making arrangements with the principal of the school for a larger room. Then vacation came and we were forced to move out of our club room. Later we rented a large room which we are using now. We have eighty-nine charter members and forty-three correspondent members. We are aided by members of Gandler Field and visiting pilots. Recently we held a contest for an attendance and membership record. This contest has proved to be very interesting to all of us.

"We have divided our club into patrols with an expert model builder at its head. We have full use of a workshop built and supported by our members. All of our expert model builders have combined and formed an advisory board. They teach the beginners the fundamentals of model building.

"We have a correspondence course which we sell to all beginners living in other states. We are completely overrun with requests for these courses and we expect to increase the number now being printed.

"We have also a system of forming patrols all over the world and we would like to get the names of boys and girls who would like to form a patrol. We assist in giving lessons and arranging the meeting place."

MODEL NEWS FROM OTHER COUNTRIES

Model Flying Club of Australia

Our friends in Australia are still going at model airplane flying "hot and heavy." Hardly a week passes without a contest of some kind taking place. Recently Gordon Davidson increased the Australian flying scale record with his Fairchild Monoplane. It flew one minute, thirty-one seconds. One of the most important contests is the series held for the Percy Marks Cup. This contest ran for twelve months and during this period Bert Martin of Cremorne won three contests and Russell Jackson of Forest Lodge won three. The tie was run off with one flight, the best to win. Jackson won with a flight of one minute, forty-nine seconds. Martin flew fifty-nine seconds.

Picture No. 17 shows the vice-president of the Club, Mr. A. A. Catts, presenting Jackson with the cup.

An unusual incident recently took place under the auspices of the Club. Model airplanes were "in the air" and "on the air" at the same time.

Picture No. 18 shows Russell Jackson of Forest Lodge about to launch a small indoor model. Mr. Freshman waits expectantly at the "mike" of Station 2FC in order to proclaim the results of the flight.

Picture No. 19 shows some Concord, N. S. W., members with their models.

Canadian Contest

The Fourth Annual Model Airplane Contest will be held in conjunction with the Canadian National Exhibition, Toronto, on August 27th and 28th, under the auspices of the Model Aircraft League of Canada. With it will co-operate a committee of the Model Aircraft League of Ontario. The contest is open to any young boy under the age of twenty-one. All inquiries about this contest should be mailed to the Model Aircraft section of the Canadian National Exhibition, Lumsden Building, Toronto, Canada.

CORRESPONDENTS WANTED

The following young men would like to have other model builders correspond with them:

Neil E. Secor of 2619 James St., Syracuse, N. Y.

F. Leroy Hart of Fairland, Okla.

John G. Pritchard of 344 S. Second St., Bangor, Pa.

Joseph Shields of 76 State St., Auburn, N. Y.

Francis C. Powers of 5 Meadow St., Salem, Mass.

Alan Clark of 1 St. Minuer Ave., North Sydney, Sydney, Australia.

Short Cuts for the Model Builder

(Continued from page 27)

strip in position on the boards, where the nails will hold it until dry.

It is often necessary to bend sheet balsa for ribs, cowling, etc. This press is designed to aid the builders in doing such work. Obtain a 1" thick board of any desired size. Drill 1/8" holes in rows in the board, as shown under "1". Cut the required number of 1/8" dowel sticks about 2" long.

The balsa is bent to shape, placed on the press, and the dowels inserted in the holes appearing next to the balsa on both its sides, as shown in "2". It is left in the press until dry.

—Readers—

Write and tell us what you think ought to be done to improve Universal Model Airplane News magazine.

—Editor

Build This World Record Twin Pusher

(Continued from page 28)

8. The leading edge for this elevator is made of ⅛ square medium balsa sanded to the shape also shown in fig. 8. It should be cut to the proper length and glued in place, but make sure that just enough space is left between it and the trailing edge so that the ribs will fit tightly. See fig. 10. Place the ribs 1 inch apart, glue them and allow them to dry. There is a piece of balsa, ⅛ inch square tapered to 1/16 x ⅛, shown in fig. 10 which is placed against the longerons between the leading and trailing edges. The thicker end is put toward the leading edge.

Now for the fittings. Make six cans out of .020 wire according to the three views shown in fig. 4. I have tried many different types of cans but the type used in this model has proved to be the most desirable. The shape of the front hook, which is made of .034 wire, is shown in fig. 2. After gluing this hook to the fuselage, wind several turns of thread around it and the fuselage. The thrust bearing must have a hole of not less than .035 inch in diameter so as to allow the shaft, which is made of .034 wire, to pass through and to revolve freely. Here, also, you will have to wind some thread around the thrust bearing and the fuselage, after gluing, so that the thrust bearing will not work itself loose during damp weather.

Now if the wing elevation blocks, made of 1/16x1/8x10 balsa, are glued to the fuselage sticks, fig. 1, the fuselage will be completed. Cover the rear elevator with superfine tissue. It is best covered in four sections which are composed of the bottom surface, the top surface within the end ribs, and the surfaces between the end ribs and the tapered pieces of balsa that were mentioned above.

Build the wing in two halves and then glue them together so that a three inch dihedral is obtained. See fig. 3. Cut, out of soft balsa, 21 wing ribs to the shape shown in fig. 8. The leading edge is made of 1/8x5/32 hard balsa. The spar and trailing edges are made of 1/16x3/16. Shape them properly and the wing can now be assembled. When the wing thus far assembled is dry, put the wing tips on. Their shape is shown full size in fig. 4. Cover the wing with superfine.

The same procedure is taken when building the front elevator as was taken in building the wing. Fig. 9 shows half of this elevator in full size. The shape of the rib will be found in fig. 8 with the rest of the other ribs. Fifteen ribs will be needed for this elevator. It is covered also with superfine tissue.

In order to get the paper tight, spray the covered surfaces with water. Since spraying the paper with water will loosen its fibers, it is weakened. Therefore, the use of dope is essential. The best solution that I have found for doping wings that are covered with superfine tissue, is composed of 3 parts of nitrate thinner and 1 part of nitrate dope. Two coats of this mixture will give an excellent finish.

The propellers are made from two 1x1½x11½ medium balsa blocks. The blanks are cut as shown in fig. 12 and 13. Then they are carved to give a right and left hand propeller. Fig. 14 shows the shape of the blade when flattened out. Trace it, place it over the blades of your propellers and cut the blades to that shape. When finished, give the props a coat of dope. For free wheeling, the device shown in fig. 6 was used but you may have a way of your own as most model builders have.

The power used for this ship is obtained from two motors consisting of 10 strands of ⅛ flat brown rubber. S hooks, as shown in fig. 7, are used to attach the rubber to the front hook.

When flying this model place the wing and the front elevator in the positions shown in fig. 15. A few winds will be sufficient for a trial flight. My ship had the ability to gain altitude on only 200 winds of the rubber. The maximum number of turns that should be given is 2000.

This model holds the world's record of 7 min., 36 sec., but I am confident that a great deal more can be done with it, so go to it.

Insignia of the U. S. Army Air Corps

(Continued from page 33)

stocks. Red bomb with two black bands, 11 black crosses on white field, all on rectangular white background piped in black.

96th Bombardment Squadron
Red devil, white aerial bomb. Black triangle with white edges.

23d Bombardment Squadron
Black volcano, with red lava flow, black bombs, white clouds, futuristic rays, alternate orange crimson and yellow, piped with white, all superimposed on circular blue background.

13th Attack Squadron
Dark blue field, white skeleton, yellow scythe with bloody blade.

77th Pursuit Squadron
Natural.

5th Observation Squadron
On blue disc piped with yellow a yellow moon and 5 stars. Owl proper, silver telescope.

4th Observation Squadron
A cross estoile divided per saltire and per cross gold and blue.

49th Bombardment Squadron
Gray wolf's head, red tongue, against orange disc edged with gray.

17th Pursuit Squadron
Owl, white on black field.

7th Observation Squadron
Blue diamond piped with red, white sword, and shield outlined in black, black portcullis.

6th Pursuit Squadron
On a circular orange field, a gray skull outlined in black forming the hub of a shaded spinning propeller done in black.

25th Bombardment Squadron
Man, proper, dressed in black, black masked, nose tip and sash, red; gray axe with bloody blade; on circular white background, piped in black.

36th Pursuit Squadron
Cloudlike background of golden orange, bordered in blue, blue helmet and white goggles with black rims. Figure brown with bloody tongue.

15th Observation Squadron
Pigeon, proper, telescope white trimmed in black, shield blue above, yellow below.

90th Attack Squadron
Red dice outlined in white with white spots.

88th Observation Squadron
Rider and horse in black silhouette on orange disc.

12th Observation Squadron
Orange disc, hawk in deep gray, white head, black projectile.

50th Observation Squadron
Square, red above, blue below.